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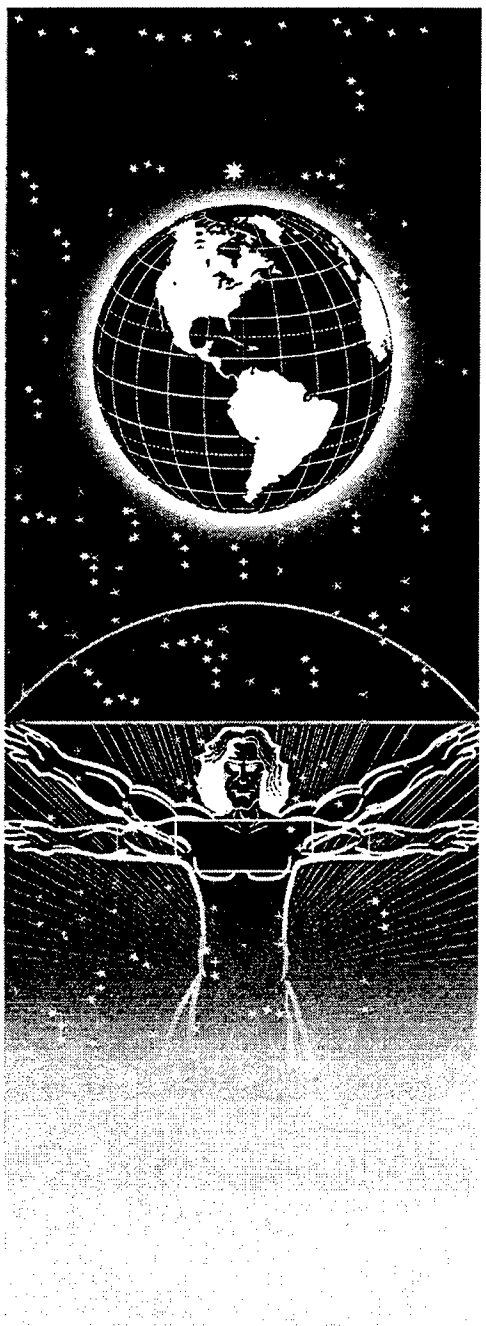

UNITED STATES AIR FORCE RESEARCH LABORATORY

INTERACTIVE MULTIMEDIA DISTANCE LEARNING (IMDL)

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13. ABSTRACT *(Maximum 200 words)*

As a result of shrinking training budgets, the Air Force is looking for ways to stretch its training dollars. One avenue of investigation has been to evaluate emerging computer and network technologies to determine if training can be delivered at a distance more efficiently than traditional classroom training. This effort focused on developing and demonstrating a PC-based distance learning system that was fully interactive and multimedia capable. Bandwidth between the instructor and distance class was provided by a dedicated T-1 landline. The class was comprised of 12 student workstations with individual cameras networked together. The network provided two-way video, audio and data as well as a link into the internet. The instructor's image or presentation materials could be delivered to large screen monitors/speakers at the front of the class or to the student's sindividual computer screens. The demonstration phase consisted of delivering an Air Force counseling course which is required training for Air Education and Training Command (AETC) instructors. The course was taught successfully in terms of students' performance on the final exam; however, some issues were identified that need to be addressed if such a system were to be deployed.

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PREFACE

This work was conducted by *Mei Technology Corporation* on behalf of the U.S. Air Force Research Laboratory, Human Effectiveness Directorate, Brooks Air Force Base. The work was performed under the Air Force, Human Systems Center contract F41624-94-C-5003. The Laboratory project monitor for this work was Major Hal Clark.

The authors wish to thank the following people who participated in the study in one form or another: Tymme Mitchell (first IMDL instructor), Steven Boyd, Rosa Garcia and the instructors and staff of the 82nd Training Support Squadron, Faculty Development Flight (especially Linda Swift, TSGT Stanley Brown and TSGT Antony Bowie) of Sheppard AFB; Ms. Sharon York of the Lackland AFB Education Office; and, CRM Films for permission to use their video *Productivity and Self-fulfilling Prophecy: The Pygmalion Effect.*

Above all a special thanks is due to Dr. Scott Newcomb who conceived the idea of such a research program and was instrumental in making the IMDL system happen. Scott's fatherly advice and kind words of encouragement will always be appreciated by the entire research team.

SUMMARY

Most existing distance learning systems rely on expensive broadcast technologies such as satellite and microwave to transmit high-quality live audio and video from an instructional origination site to remote classrooms. Such systems require substantial up front investment for equipment purchase and installation, as well as ongoing costs in the form of maintenance, technical and logistical support. These expenses relegate most distance learning systems to one-way video/two-way audio, since the cost of installing satellite or microwave up-links at remote sites and purchasing additional broadcast channels for student feedback can be prohibitive. The IMDL system described in this report takes advantage of high bandwidth telephone lines and multimedia computer workstations networked together to create a virtual learning environment. In this virtual learning environment not only is the instructor present to the students, but the remote students are also present for the instructor and to each other.

By establishing a virtual learning environment IMDL technology permits the same kinds of interaction that take place in a traditional technical training classroom to take place at-a-distance. Instructors can demonstrate equipment and procedures to students. Students can ask instructors a wealth of questions not previously possible about specific equipment components and procedures. In fact, students can demonstrate their mastery of concepts by translating them into action and remote instructors can witness their activities just as they do in traditional classrooms. Evaluation of student performance is virtual yet effective.

Results of the IMDL technology configuration and testing are reported. This includes a complete description of the system components, operation and problems encountered. Results of one class which was trained using IMDL technology are also reported here. The demonstration provided a proof of concept that IMDL technology can be used effectively for technical training. Some additional research questions remain to be answered, such as, how cost effective is IMDL technology compared to other distance learning technologies, what ways can IMDL technology be best used to take advantage of all of its capabilities, and how can existing courses be converted to IMDL technology.

INTRODUCTION

Although many distance learning programs currently exist and more are being developed, each program appears to follow an independent path of implementation, i.e., with little consideration of previous experience. While there are numerous lessons to be learned about implementing distance learning, no clear guidance exists from which typical Air Force users can draw. It is apparent that non-technical training has been the primary target of distance learning in the Air Force. However, the majority of Air Force training is aimed at providing personnel with the required skills to become novice or apprentice level technicians, e.g., nearly all of AETC's technical training program has this as its goal. It would be a mistake to assume that basic technical training should be the only, or even the primary target for application of distance learning technology. Personnel, once they complete their basic technical training, are assigned to a duty station where they continue, for the duration of their careers, their training through career development courses and proficiency or on-the-job training. Personnel must acquire numerous new skills which require close oversight and frequent practice to maintain or increase their proficiency. Proficiency training requires that supervisors or instructors provide oversight. Therefore finding training time at operational bases is difficult. It appears that a realistic distance learning target audience is composed of technicians who have completed their technical training and have been practicing their occupational skills on-the-job or now require upgraded skills because of equipment modifications, job re-engineering, changes in duty position, or an emergency situation, e.g., operation *Desert Storm*.

Another important factor to be considered is the characteristics of Air Force instructional developers, instructors, and the kind of tools they have at their disposal for the development of distance education. Currently, instructional design activities are performed by a wide variety of individuals across the complete spectrum of instructional design skill levels from multimedia expert to complete novice to instructional systems development. AETC has staffed training development flights that have primary responsibility for instructional design activities. However, whether training development flights are capable of handling the entire load of training development work for distance learning remains to be seen.

Currently existing satellite-based one-way video/two-way audio provide the Air Force with the basic elements for distance learning. However, it is improbable that satellite-based one-way video/two-way audio is the most appropriate solution for each (or even most) AETC technical courses. Technical skill-intensive courses such as aircraft assembly, operation, and repair require visual feedback from students to instructor while other knowledge-intensive courses need to allow for an individualized student response capability.

Technology Development

In an era of declining operating revenues, none of the preconfigured distance learning systems we are aware of are suitable for the kind of rich interaction required for career development courses and proficiency training. Two-way satellite systems provide high-quality visual communications and are capable of managing bi-directional data traffic, are expensive to install and maintain, and inflexible in location. Many satellite and microwave systems use one-way video with telephone-based feedback from remote sites to reduce costs and maintain flexibility. Indeed, multimedia data communications can be implemented with such systems However,

instructor control and coordination with the remote classrooms is limited without visual feedback to the instructor site (Wilson, Teasley & Ittelson, 1992), as is instructor and student satisfaction with the learning experience (Dickinson & Nichol, 1993). Microwave and Cable TV (CATV) are less expensive technologies to operate on a daily basis and offer good feedback from remote sites, but they are constrained to relatively small areas. Microwave or CATV links across any substantial distance quickly become more expensive than two-way satellite. None of the existing two way distance technologies can easily accommodate just-in-time training or the addition of new sites.

For all of these reasons, a computer based multimedia videoconferencing technology that takes advantage of the switched public network seems to offer a viable solution that meets the requirements of career development courses and proficiency training. Computer based multimedia videoconferencing technology is geared toward providing two way video and audio. Computer based multimedia videoconferencing technology can be configured to accommodate a digital data stream for multimedia control and coordination. The network infrastructure is already in place and is maintained by the regional Bell operating companies.

Many of the technologies developed for videoconferencing and broadcast instructional television systems can be judiciously used to develop a multimedia distance learning system that will meet the goals of the Air Force in the near term, while remaining easily upgradeable to emergent technologies. For the purposes of this research, multimedia distance learning systems can be broken down into four separate functions: 1) the audiovisual transmission from the instructor to remote student sites; 2) the audiovisual feedback loop from student sites to the instructor's location; 3) a multimedia data network to allow interactive media control and presentation; and 4) means of providing for individual student interaction. An extensive technology evaluation provided the basis for selecting technologies and commercial-off-the-shelf products to develop a multimedia distance learning system that enables the same level of interaction found in traditional live classroom instruction, career development courses, and proficiency or on-the-job training.

In this report we describe the Interactive Multimedia Distance Learning (IMDL) system. The IMDL system is an information technology based interactive multimedia distance learning environment that is capable of supporting a variety of instructional design models.

The IMDL project had two objectives:

1. develop a prototype distance learning system that uses networked multimedia workstations across a wide variety of interactive instructional strategies and media, and
2. conduct studies that identity the advantages and disadvantages of IMDL.

IMDL PROTOTYPE

The IMDL system is designed to provide smooth delivery of multimedia instruction to students in locations remote from the instructor. IMDL provides instructors with the ability to interact with students in real time while presenting instruction in a variety of different media formats. Features of IMDL include:

- ***Multimedia Courseware.*** Instructors can develop courses and lesson modules using *PowerPoint* presentations, digital video, or analog video. They can also use cameras to give real-time demonstrations.
- ***Internet Access.*** Instructors and students can access information on the Internet.
- ***Real Time Interaction.*** Instructors can interact with the entire class, student groupings within the class, or hold private conversations with individual students.
- ***Two-way Video.*** Instructors can view the whole classroom or just one student, while students can view the instructor or a specific student asking a question.
- ***Student Feedback.*** Students can give instructors feedback on the pace of a class presentation so that the instructor can adjust the teaching approach accordingly.
- ***Student Evaluation.*** IMDL provides the capability to develop embedded questions for assessing student progress. Instructors can see a graph of overall student performance, or they can then choose to see a list indicating each student's answer.

IMDL Capabilities

Hardware

The IMDL system was equipped with interactive two-way desktop video and two-way audio. Data, digital audio/video and analog audio/video are transmitted over a T1 line. For the prototype demonstration, the T1 line was configured as two 750 Kbps channels. Students view instruction at desktop workstations or on two 35" classroom monitors depending on how the instructor configures the IMDL system. Overview schematics of the IMDL system are shown in Figure 1 (instructor site) and Figure 2 (classroom site).

The major components of the instructor site (Figure 1) are: the PC workstation, monitors, camera(s), and control panel. The PC workstation is a source of instructional content and is used to manage the IMDL system. One monitor is used to show the view being sent to students at a distance and the other to see the distant students/classroom. One of the instructor site cameras is always used to focus on the instructor. For example, the 6 position PTZ room camera allows for 6 different views of the instructor site. The other instructor site camera is used for displaying educational materials at close range. The control panel is used to manage the instructional events and resources at the instructor site, at the distant student workstations, or at the distant classroom.

The major components of the classroom site (Figure 2) are: the PC workstations, room cameras, 35" inch TV monitors, and control panel. The student PC workstation is the primary presentation source for instruction. Each PC workstation includes:

- 200 Mhz Pentium processor with 16 MB of memory,
- 1 GB hard drive,
- 4 MB video graphics card (ATI 3D xpression + PC2TV and ATI TV card) with both PC and TV display and TV broadcasting capability,
- 32 bit sound card,
- Workstation camera.

The classroom cameras are used to view the students and classroom from different perspectives. In the current prototype classroom configuration (Figure 3) there is a fixed camera at the front of the distant classroom, a 100 position PTZ camera in the back of the distant classroom, and a camera at each student PC workstation. The classroom site control panel functions identically to the instructor site control panel. The student site control panel and classroom server can be used to manage the instructional events and resources available at the distant instructor site, at the local student workstations, or at the local classroom.

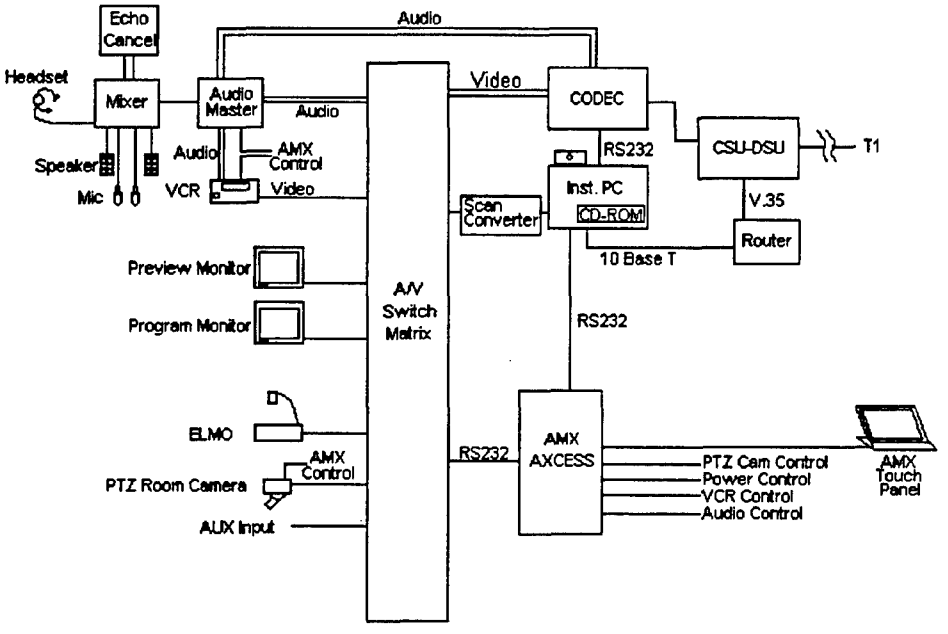

Figure 1. Instructor Site Hardware

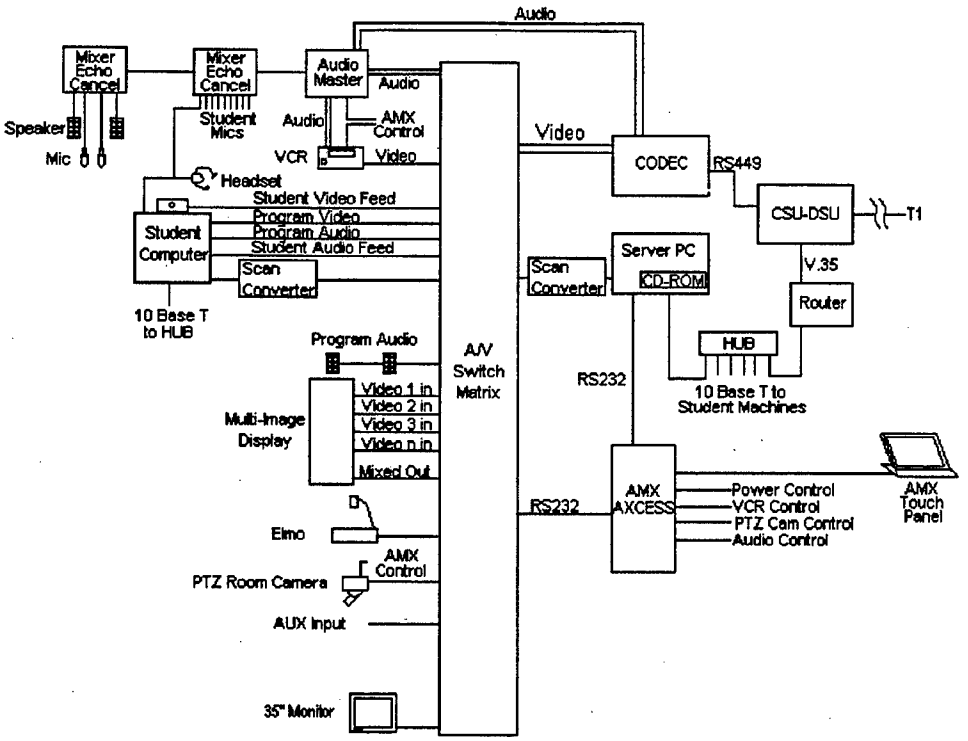

Figure 2. Classroom Site Hardware

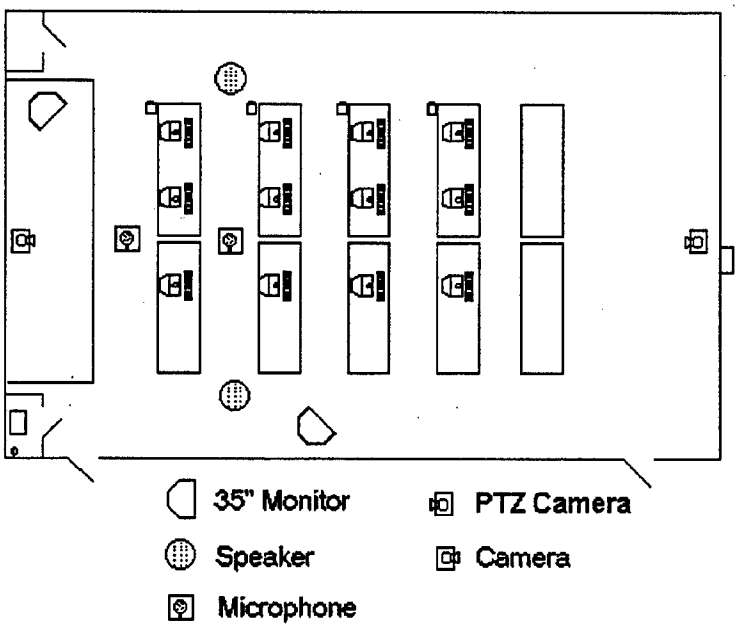

Figure 3. IMDL Classroom Configuration.

The IMDL system is controlled by sending commands over the communications subsystem (Figure 4). The TCP/IP connection at the instructor site is attached to the instructor's workstation. The TCP/IP connection at the classroom site is connected to the 12-student

workstations and the classroom server. Analog video inputs and outputs at both sites are connected to their respective A/V switch. Audio inputs and outputs are connected to their respective audio master. In addition, both the audio and the video inputs and outputs are independently switchable.

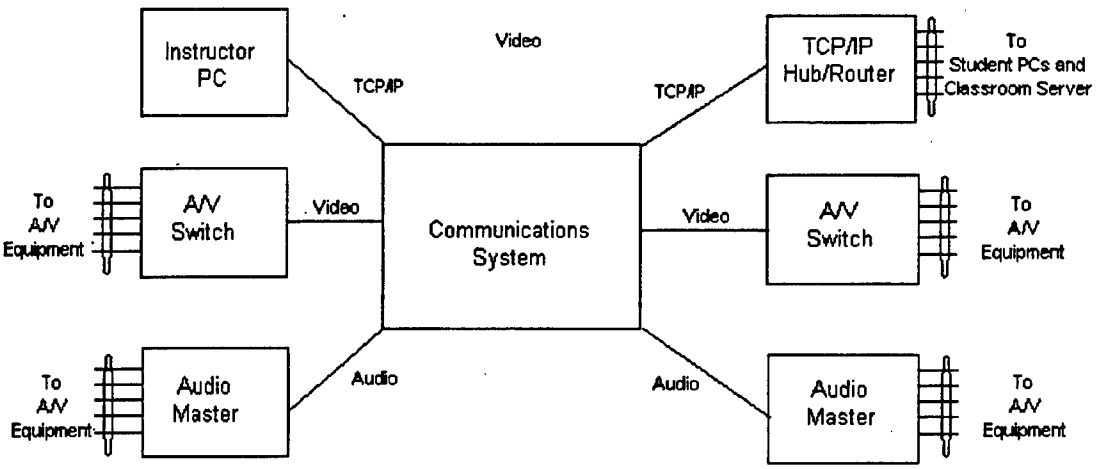

Figure 4. Switching Control Path.

To route a signal from a particular source to a specific destination, the communications system establishes a path by sending switching commands over the TCP/IP network to the A/V switch and audio master. For example, to allow the instructor to communicate with one student the following switching commands are sent from the instructor PC:

- To the instructor A/V switch:
  1. Route instructor camera video to the communications system
  2. Route instructor camera video to the instructor program monitor
  3. Route communications video to the instructor preview monitor
- To the classroom A/V switch:
  1. Turn off video output to each of the student stations (close the instructor window)
  2. Route communications video to the selected student station
  3. Route video input from the selected student station to communications system
- To the instructor audio master:
  1. Route the instructor microphone to the communications system
  2. Route the communications system audio to the instructor headset ear piece
- To the classroom audio master:
  1. Turn off all audio output to all student stations (turn off each student's headset)
  2. Route communications audio to the selected student station headset ear piece
  3. Route the selected student station headset microphone to the communications system

These commands establish a two-way audio and two-way video path between instructor and a selected student. In addition, commands are issued to the other student stations to make the display more presentable. The instructor video window is hidden on stations which are not

receiving a video signal and the instructor window is made visible (if it is not already visible) and moved to the upper left corner of the selected student's computer screen (a discussion of the instructor and student screens follows).

The instructor's A/V switch is controlled through an RS-232 serial port on the instructor station PC. Any command to the instructor's A/V switch is passed first to the AMX (via RS-232), then to the attached A/V switch (again via RS-232). Control of the classroom A/V switch is through an RS-232 serial port on the classroom server. In order for the instructor PC to issue a command to the classroom A/V switch, the command is first sent to the classroom server PC (via TCP/IP) which relays the command to the AMX via it's RS-232 port, which in turn relays it to the A/V switch.

Playing a computer based video (either AVI or MPEG) requires coordination between the various PC's (using the TCP/IP communication path), and does not require commands to the A/V switch. Computer based videos are multicast either from the classroom server or from the instructor's PC to each client PC in the system, i.e., the student stations.

Instructor Site

Instructor site software enables instructors to perform numerous classroom functions including:

- **Lecture and demonstrate**.
    - Communicate with **all** students.
    - Communicate with a **subgroup** of students.
    - Communicate with a **single** student.
    - Demonstrate a procedure to **all** students.
    - Demonstrate a procedure to a **subgroup** of students.
    - Demonstrate a procedure to a **single** student.
- **Question**.
    - Identify that a student needs attention.
    - Call on a student **publicly** where the instructor is visible to the *called on* student while the *called on* student is visible to all other students in the class.
    - Call on a student **privately** where the student and the instructor conduct a private conversation.
- **View distant classroom**.
    - View the entire classroom from different camera perspectives.
    - View an individual student's computer screen.
    - View an individual student.
    - View a student demonstration.
- **Execute stand-alone programs on student workstations**.
    - Computer Based Instruction
    - Games
    - Other stand-alone executable application
- **Public address**.
    - Address and view the distant classroom using the classroom large central screen and speakers.

- **Access the Internet.**

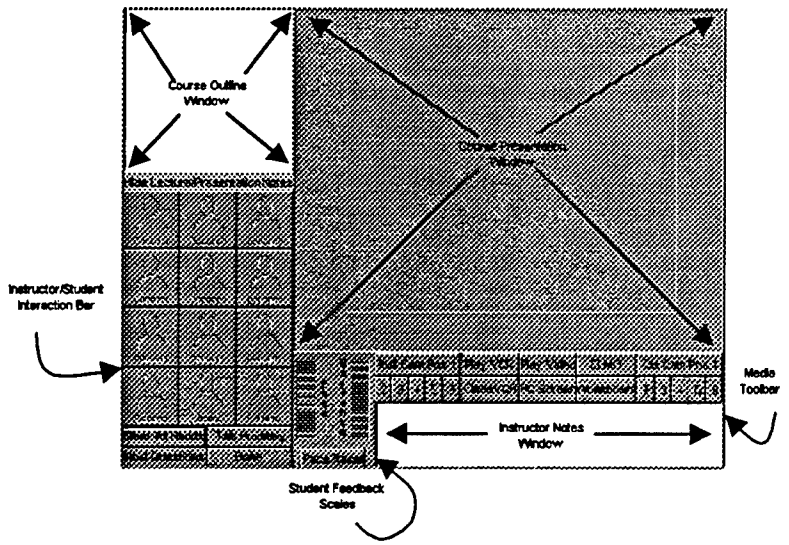

Figure 5. Instructor Screen

Instructor's Screen

The instructor's screen is shown in Figure 5. There are six principal parts of the instructor's screen. They are labeled in Figure 5 and are described below.

Course Outline Window. An outline of the course is shown in the *Course Outline Window*. The course outline consists of a listing of the modules that constitute the course. Although modules may be executed in any order, they are organized in an outline form that follows a typical Air Force plan of instruction.

Course Presentation Window. As expected, the *Course Presentation Window* is the largest portion of the screen. This is where instructional materials currently being used as support for the instructor, such as a *PowerPoint* presentation or video, are displayed for the instructor. This window enables the instructor to see what is being sent to the student screens.

Instructor/Student Interaction Bar. The *Instructor/Student Interaction Bar* provides buttons that can be used to call on a student and to determine which specific student wants to ask a question. Buttons are also available that enable the instructor to hold questions, clear hand-raises, or talk privately with one student.

Student Feedback Scales. The student feedback scales are designed to help instructors tailor the pace of instruction. The pace scale indicates the class' overall perception of the pace of the course, i.e., too fast or too slow. The variance scale indicates the range of student responses. The **Pace Reset** button allows the instructor to reset the student feedback scales to their original values.

Media Toolbar. The *Media Toolbar* provides the instructor the ability to choose camera positions, use the whiteboard, play computer video, use the Elmo camera, or play the VCR.

Instructor's Notes Window. The *Instructor's Notes Window* displays privately to the instructor any notes that may have been entered about the instructional element being presented. Notes are not meant for students and, therefore, are not broadcast to the classroom.

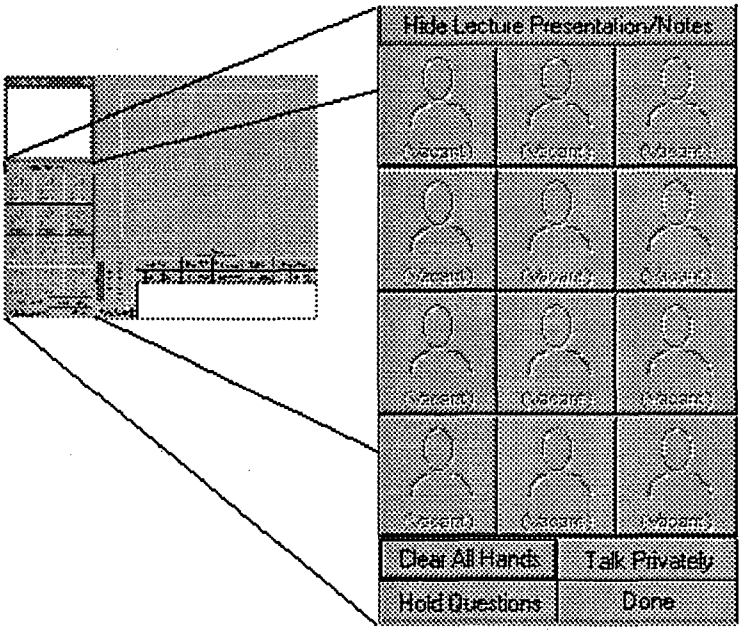

Figure 6. Instructor-Student Interaction bar

Instructor-Student Interaction

The Instructor-Student interaction bar (Figure 6) has buttons that control interactions with the students. The buttons are as follows:

Hide Lecture Presentation/Notes. This button, if selected, will hide the *Course Presentation Window* from both the instructor's and the student's screens.

Call On Student. If any of the 12 individual student buttons are selected, this will cause the IMDL system to (1) route the instructor's image and audio to the specific student's monitor and (2) route the selected student's audio and output from the student workstation camera to all other students in the classroom and to the instructor. If the **Talk Privately** button is also selected, the IMDL system will route the selected students image and audio to the instructor alone.

Clear All Hands. This button clears the hand raise for each of the students. On the instructor workstation, all the **Hand Raise** buttons will return to the *students with hands down* position. On the student workstations the **Hand Raise** button will show each student that their hand is down.

Talk Privately. This button enables the instructor to conduct a one-on-one meeting with a student. It enables the instructor to speak exclusively to the student called on. This button has no effect if a student has not been called on.

Hold Questions. This button disables questioning. At the student workstations the message "Please Hold Your Questions," is displayed just below the **Hand Raise** button.

Done. Performs the combined functions of *uncalling* any student *called on* and resetting the **Talk Privately** button. **Done** also returns the instructor workstation to the instructional mode that was in effect prior to the student being called on.

For system redundancy, there are also buttons on the AMX device that perform similar functions.

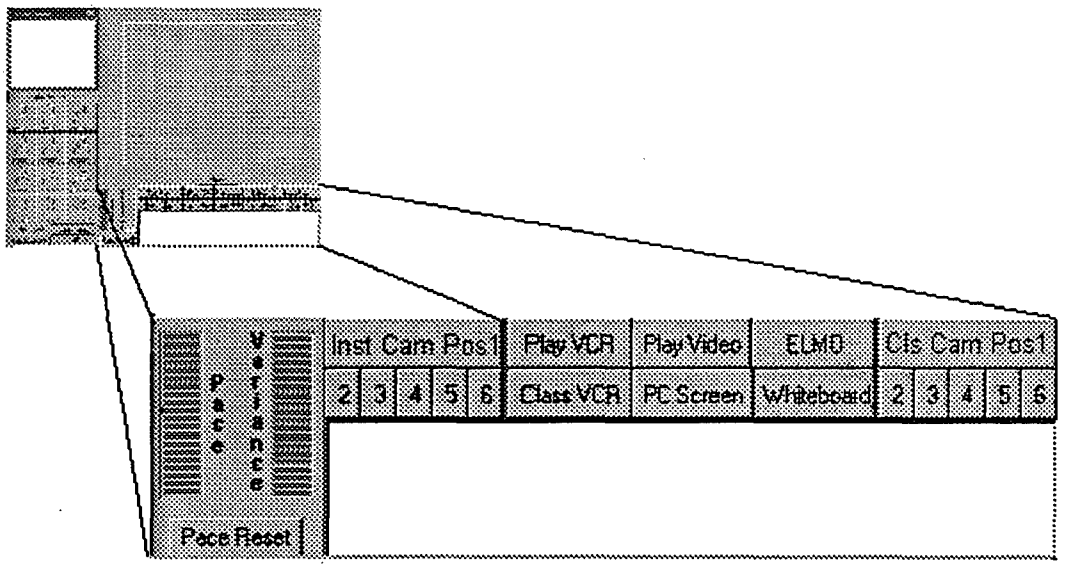

Figure 7. Media Toolbar and Student Feedback

Student Feedback and Media Toolbar

The *Student Feedback Scales* (Figure 7) are designed to help instructors tailor the pace of instruction. The pace scale indicates the class' overall perception of the pace of the course, i.e., too fast or too slow. The variance scale indicates the range of student responses. The **Pace Reset** button allows the instructor to reset all student feedback scales to their original values. The Media Toolbar (Figure 7) provides the instructor with buttons that enable the selection of different media sources. The indicators and buttons are as follow:

Pace Indicator. Each student station has a slide bar that enables them to indicate their feelings about the pace of the instruction. Students can adjust their bar *left* to indicate that the instruction is progressing too slowly or *right* to indicate that the instruction is progressing too fast. The pace indicator on the instructor's screen indicates the overall average of all the student pace slider (Figure 15)settings.

Variance Indicator. This scale indicates the variance calculated from the pace data. This enables the instructor to determine whether the pace information is coming from the entire class or just one or a few students.

Pace Reset. This clears both the Pace and Variance indicators and resets the student slide bar indicators to the middle of the range.

The Media selection buttons enable the instructor to change the primary instructional source and focus. Selection of one of these buttons reconfigures the IMDL system into one of the following modes:

Inst Cam Pos 1 → 6. These buttons allow the instructor to lecture/demonstrate from one of six pre-selected PTZ camera locations at the instructor site. For example, an instructor might configure the PTZ camera to focus to a particular area where a procedure is to be demonstrated. When this pre-programmed button is selected the source of input to the instructional window switches from the instructor workstation to the PTZ camera. These buttons are only active if the instructor site has a six position PTZ camera.

Play VCR. A VCR button saves the current video state and activates the instructor site VCR. It is assumed that the VCR has been powered on and a tape has been loaded for viewing. The saved video state is restored when the button is unclicked so, for example, it is possible to transition smoothly from lecture mode to playing a VCR and back to lecture mode.

Class VCR. Performs the same function as the **Play VCR** button, but operates the classroom VCR instead of the instructor site VCR. As with the instructor VCR, the VCR must be powered on and a tape loaded for viewing. The saved video state is restored when the button is *unclicked* so that transitions are smooth.

PC Screen. Displays the instructor's *Course Presentation Window* to all student stations. This can be used in cases where the instructor wishes to demonstrate some computer based application.

Play Video. Calls up a window that enables the instructor to select a computer-based video file to be played on the student workstations. The video file may reside on either the instructor station or on the classroom server computer.

Whiteboard. Activates a whiteboard associated with the IMDL system. The whiteboard is used to annotate the course presentation window or to create screens *on the fly* to be displayed on the student workstations.

ELMO. This video device enables the instructor to show students close ups of items. It broadcasts the NTSC video obtained from an ELMO camera.

Cls Cam Pos 1 → 6. These buttons allow students to lecture/demonstrate from one of six pre-selected PTZ camera locations in the classroom. For example, an instructor might configure a PTZ camera to focus to a particular area where a procedure is to be demonstrated. When this pre-programmed button is selected the source of input to the course presentation window switches from the instructor workstation to the PTZ camera. These buttons are only active if the classroom site has a six position PTZ camera.

There are also AMX buttons that perform similar functions.

AMX Control Panel

The AMX control panel provides touch control screens, which are used along with the instructor's screen to deliver instruction. The control panel includes the instructional delivery functions found on the instructor screen as well as additional functions that can be use to fine tune the instruction. Major functions of the control panel and its screens are described below. The control panel has six primary screens:

1. location startup screen,

2. main screen,
3. power control screen,
4. equipment adjustment screen,
5. student feedback screen, and
6. program control screen.

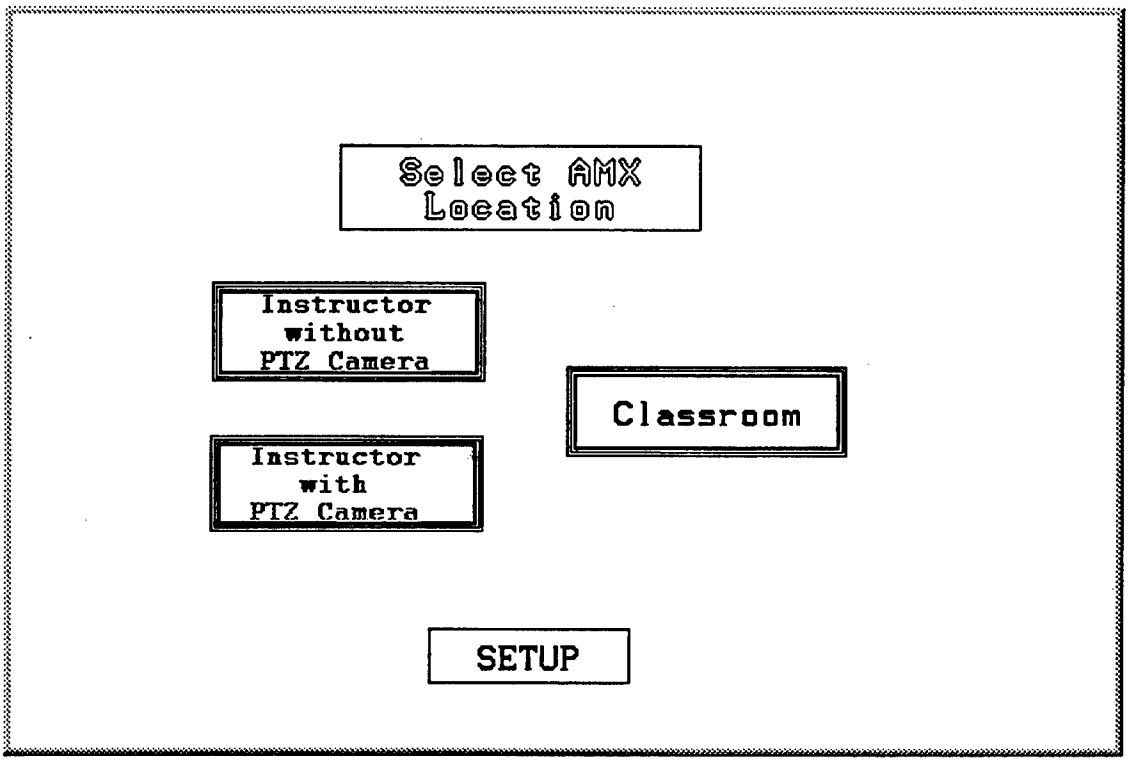

Figure 8. Location Startup Screen

Location Startup Screen

The *Location Startup* screen is shown in Figure 8. The IMDL system is designed so that virtually the same software runs on both the instructor and classroom control panel. It is possible to control the system from either the instructor workstation or the AMX Control Panel. As part of the IMDL system configuration, the system needs to know the location of this AMX panel. Therefore, immediately after power-up the system displays this screen. The **Instructor without PTZ Camera** button tells the system that the source of the instruction is a distant site and that the instructor workstation is configured with a single fixed camera. The **Instructor with PTZ Camera** button tells the system that the source of the instruction is a distant site and that the instructor workstation is configured with a fixed camera and six position PTZ camera. The **Classroom** button tells the system that source of the instruction is the classroom and that the instructor workstation is configured with fixed camera and six position PTZ camera.

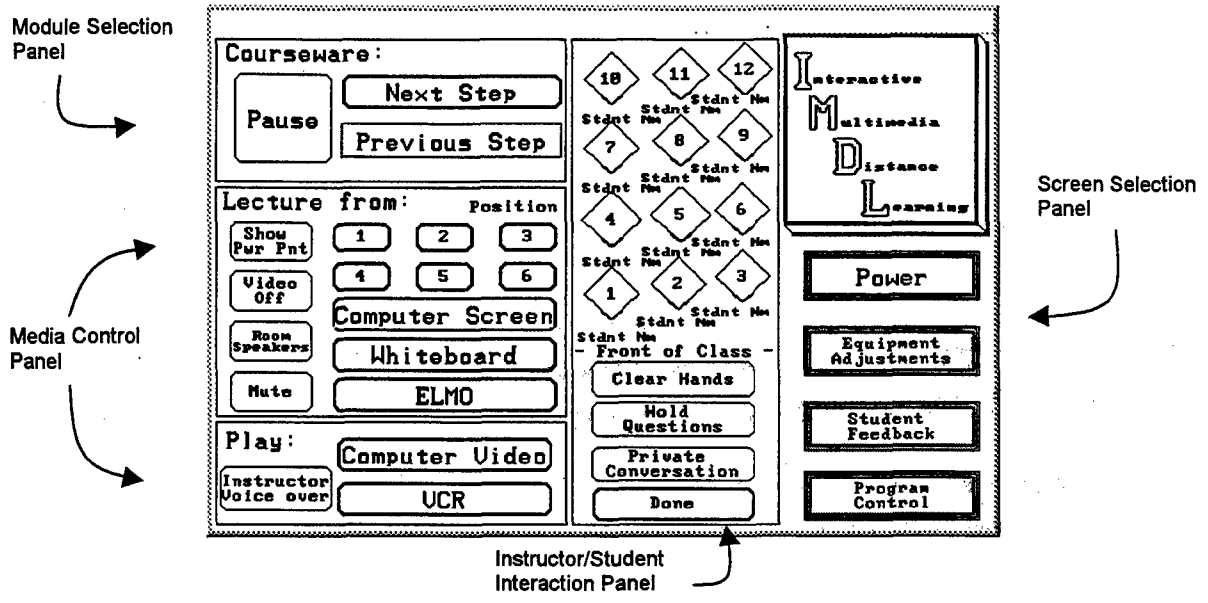

Figure 9. Main Control Screen

Main Control Screen

The *Main Control* screen is shown in Figure 9. System functional control modules are labeled in Figure 9 and are described below.

Module Selection Panel (Courseware). The *Module Selection Panel* controls the presentation of modules listed in the *Course Outline Window* (see Figure 5). If the **Next Step** button is selected the next module in the course outline is presented. If the **Previous Step** button is selected the previous module in the course outline is presented.

Instructor/Student Interaction Panel. The Instructor Panel works like *the Instruction-Student Interaction Bar* found on the instructor monitor (see Figure 6). The twelve buttons represent the student workstations. These buttons are used to call on an individual student or, when the button is highlighted, to respond to a student question. When the instructor selects one of these buttons the IMDL system (1) routes the instructor audio and image to the selected student's monitor, and (2) routes the selected student's audio and the output from the student's camera to all other students in the class and to the instructor. The **Clear All Hands** button clears the hand-raise at each of the student workstations. The **Private Conversation** button allows the instructor to speak privately to a student. When **Private Conversation** is selected, the instructor audio and image are routed to the selected student's monitor and the selected student's audio and image are routed only to the instructor(it is best if this function is used before or after the regular class to minimize disruption to the other students). The **Hold Questions** button disables questioning. It signals that students should hold their questions. The **Done** button *uncalls* a *called on* workstations or resets the **Private Conversation** button.

Media Control Panel. The Media Control Panel allows the instructor to choose a camera position, use the whiteboard, play some computer video, use the Elmo camera, or play a tape from the VCR. The Media Control Panel has two sub-panels: *Lecture from* and *Play*.

Lecture from. The buttons labeled **1→6** allow the instructor to move about the instructor site and lecture from pre-selected PTZ camera locations. The **Computer Screen** button broadcasts the instructor *Course Outline Window* to the selected student workstations. The **Whiteboard** button activates a whiteboard which enables the instructor to annotate screens or to create new screens *on the fly*. These screens can then be shared with the students. The **Elmo** button allows the instructor to use the Elmo camera for close-ups, write notes on printed drawings, or draw freehand sketches, etc. The output from the Elmo is then broadcast to the student workstations and displayed in the *Course Presentation Window*. The **Show Pwr Pnt** button is used to select and play a PowerPoint file. The **Video** button toggles the instructor image. If the button is **Video off**, the instructor camera is off and no image of the instructor is sent to the student workstations. If the button is **Video On**, the instructor camera is on and the instructor image is sent to the *instructor/student window*. The **Room Speakers** button allows the instructor to talk over the classroom PA system. If the **Room Speakers** button is toggled on, the classroom PA system is active. If the **Room Speakers** button is toggled off, the classroom PA system is disabled. The **Mute** button toggles the instructor audio on and off.

Play. The **Computer Video** button allows the instructor to select and play a digital video file. The digital video is played in the *Course Presentation Window*. The **VCR** button enables the instructor to play a videotape from the instructor VCR. The videotape is played in the *Course Presentation Window*. The **Instructor Voice Over** button toggles the instructor audio on and off. If the **Instructor Voice Over** button is selected the instructor can voice over and comment on a playing digital video or videotape.

Screen Selection Panel. The Screen Selection Panel toggles the Main Control Screen with the Power, Equipment Adjustment, Program Control, and Student Feedback Panels.

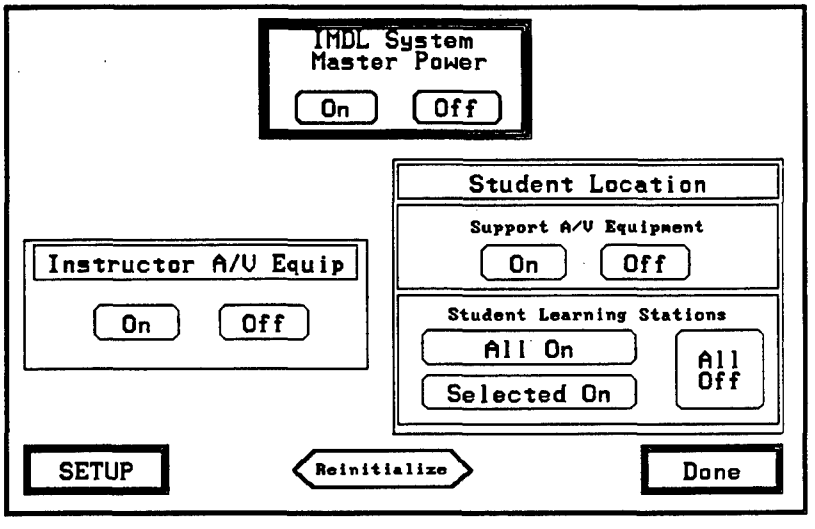

Figure 10. Power Control Screen

Power Control. The **Power Control** button toggles the AMX control panel to the power control screen (Figure 10). The power control screen enables the instructor to control power for equipment at the instructor site and for equipment in the remote classroom. The **IMDL System Master Power** panel is used to power-up or power-down all

attached equipment. The *Student Location* sub-panel allows the instructor to power-up the classroom audiovisual equipment and the student workstations in the distant classroom. The student workstations are powered-up all at once by the **All On** button. Selected student workstations can be powered-up by the **Selected On** button. The **All Off** button powers-off all student workstations. The *Instructor A/V Equip* sub-panel is used to power-on and power-off audio/visual equipment at the instructor site. The **SETUP** button is used to configure the AMX Control panel. The **Reinitialize** button restarts the AMX Control panel. The **Done** button returns the AMX control panel to the Main Control Screen. Complete details on operation of the AMX panels is found in the system operating manuals.

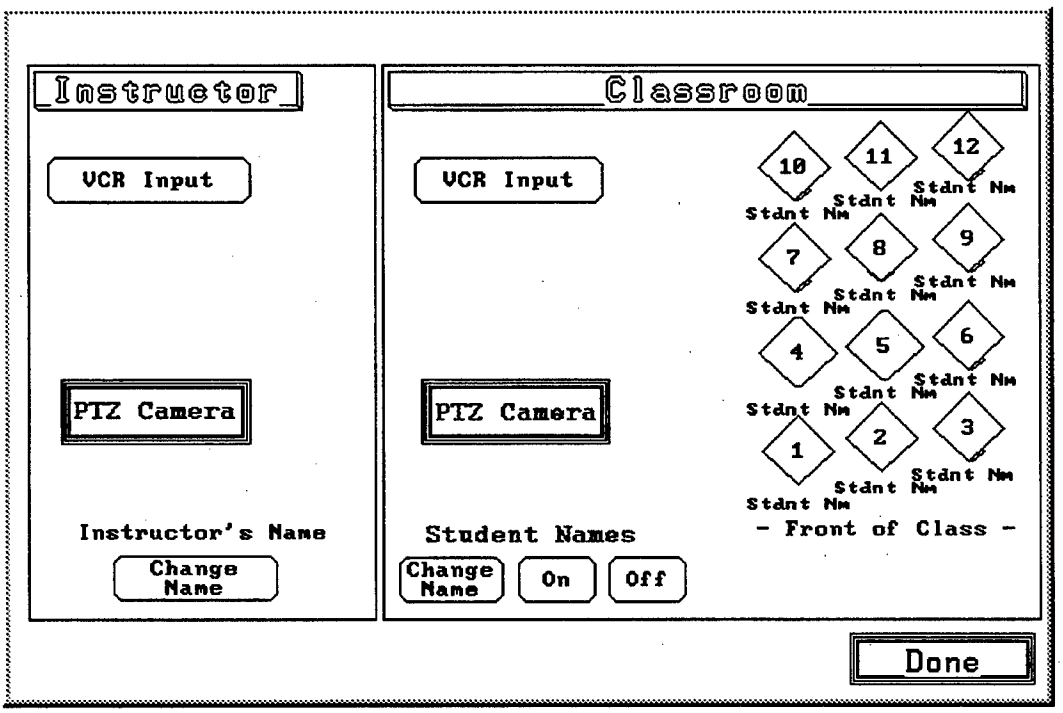

Figure 11. Equipment Adjustment Screen

Equipment Adjustment. The Equipment Adjustment screen is used to pre-set or adjust the system VCRs and cameras (Figure 11). The Equipment Adjustment screen has two panels: *Instructor* and *Classroom*.

Instructor. The Instructor panel is used to manage the instructor VCR, PTZ camera, and instructor name. The **VCR Input** button prepares the VCR for recording. When selected from the instructor panel the **PTZ Camera** button is used to position and control the instructor site PTZ camera (Figure 12). The **Preset** buttons allows the instructor to position and focus the PTZ camera anywhere within its field of view. At each of the **Preset** locations the camera can be adjusted using the *Camera Control* buttons **Pan/Tilt**, **Zoom**, and **Focus**. Selecting one of the *Remember current position as* buttons saves the current camera position. Selecting one of the *Go to position* buttons focuses the camera at the saved position.

The **Done** button returns the AMX control panel to the Main Control Screen.

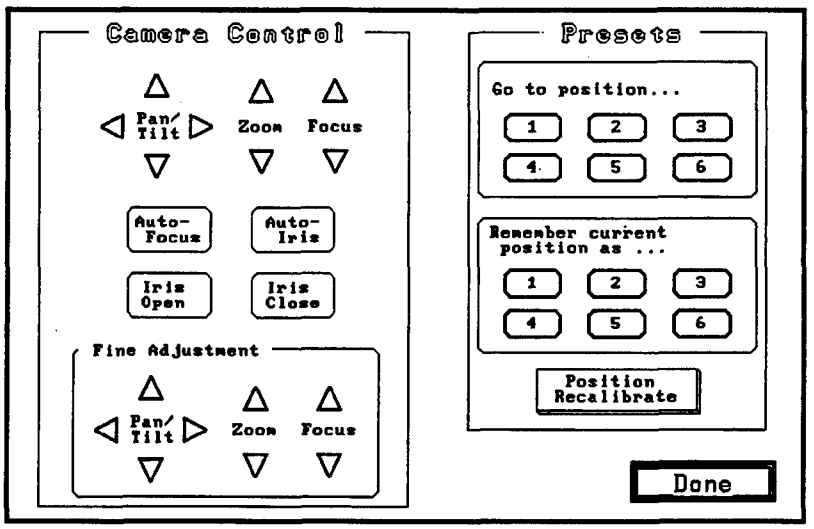

Figure 12. Camera Setup Screen

Classroom. The Classroom panel (Figure 11) is used to manage the classroom VCR, PTZ camera, and student names. The twelve diamond-shaped buttons represent the student workstations in the remote classroom. The buttons are used to add or change students names. Entering a student's name for each workstation gives the instructor a quick reference at his or her fingertip. The **Change Name**, **On** and **Off** buttons are used to manage the naming process. The **VCR** button is used to prepare the classroom VCR for recording. The **PTZ Camera** button is used to remotely control the classroom PTZ camera (Figure 12). The **Preset** buttons allows the instructor to position and focus the PTZ camera anywhere within its field of view. At each preset location the camera can be adjusted using the *Camera Control* buttons **Pan/Tilt**, **Zoom**, and **Focus**. Selecting one of the *Remember current position as* buttons saves the current camera position. Selecting one of the *Go to position* buttons focuses the camera at the saved position.

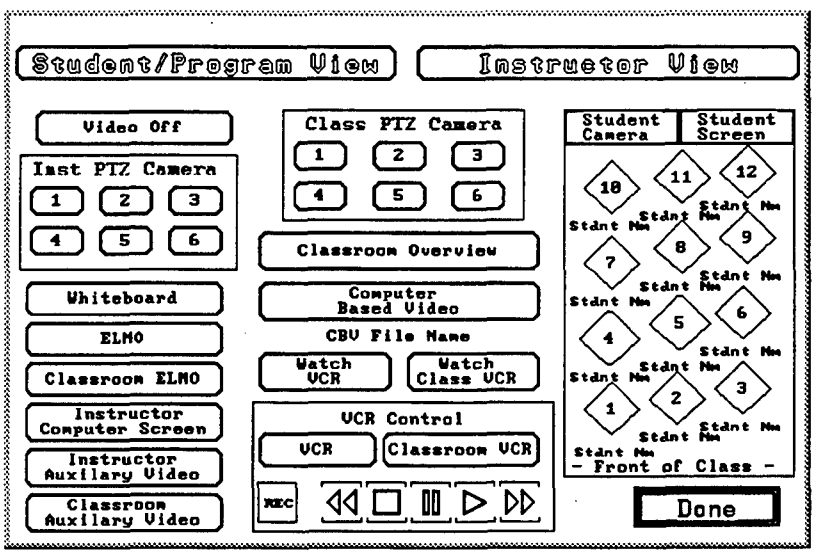

Figure 13. Program Control Screen

Program Control. The program control screen (Figure 13) is used to manage the instructor's and the students' views of the instruction.

Student/Program View. The **Student/Program View** button is used to manage the delivery of instruction to students. For example, when the **Student/Program View** button is selected with other buttons on the program control screen it routes the output of a selected device both to the instructor screen and to all the student workstations. More specifically, selecting the **Student/Program View** button, **Student Screen** button, and a student **Workstation** button captures the screen of the selected student and routes it to the instructor and all the other students. Further, selecting the **Student/Program View** button, **Student Camera** button, and student **Workstation** button routes the output of the student's camera to the instructor as well as all the other students. A full list of functions and button combinations is listed in Table 1.

Instructor View. The **Instructor View** button is used to manage the instructor's view. By toggling **Instructor View** on, the instructor can view a video, choose a camera position, etc., without displaying it to the student screens. When the **Instructor View** button is selected with other buttons in the program control screen it routes the output of the selected device to the instructor preview monitor alone. **Instructor View** works exactly like **Student/Program View** except the output of the selected device is routed to the instructor preview monitor exclusively. A complete list of functions and button combinations are listed in Table 2.

Classroom Resources	Student Monitor		Student Audio		Class Monitor 1	Class Monitor 2	Room Speaker	Inst Monitor 1	Inst Monitor 2	Inst Audio
	All	Selected	All	Selected						
Instructor Camera	x	x			x	x		x	x	
Instruction Window (AVI, MPEG, Power-Point, etc)	x	x			x	x		x	x	
Computer Screen	x	x			x	x		x	x	
Whiteboard	x	x			x	x		x	x	
ELMO	x	x			x	x		x	x	
Lecture Camera	x	x			x	x		x	x	
Inst VCR	x	x	x	x	x	x	x	x	x	
Inst Mike 1			x	x			x			
Room Camera 1 (100 Positions)	x	x			x	x		x	x	
Room Camera 2 (Fixed)	x	x			x	x		x	x	
Room Mike 1			x	x			x			x
Room Mike 2			x	x			x			x
ELMO	x	x			x	x		x	x	
Student Camera 1	x	x	x	x	x	x		x	x	
Student Screen 1	x	x			x	x		x	x	
Student Mike 1			x	x			x			x
Student Camera 2	x	x			x	x		x	x	
Student Screen 2	x	x			x	x		x	x	
Student Mike 2			x	x			x			x
Student Camera 3	x	x			x	x		x	x	
Student Screen 3	x	x			x	x		x	x	
Student Mike 3			x	x			x			x
Student Camera 4	x	x			x	x		x	x	
Student Screen 4	x	x			x	x		x	x	
Student Mike 4			x	x			x			x
Student Camera 5	x	x			x	x		x	x	
Student Screen 5	x	x			x	x		x	x	
Student Mike 5			x	x			x			x
Student Camera 6	x	x			x	x		x	x	
Student Screen 6	x	x			x	x		x	x	
Student Mike 6			x	x			x			x
Student Camera 7	x	x			x	x		x	x	
Student Screen 7	x	x			x	x		x	x	
Student Mike7			x	x			x			x
Student Camera 8	x	x			x	x		x	x	
Student Screen 8	x	x			x	x		x	x	
Student Mike 8			x	x			x			x
Student Camera 9	x	x			x	x		x	x	
Student Screen 9	x	x			x	x		x	x	
Student Mike 9			x	x			x			x
Student Camera 10	x	x			x	x		x	x	
Student Screen 10	x	x			x	x		x	x	
Student Mike 10			x	x			x			x
Student Camera 11	x	x			x	x		x	x	
Student Screen 11	x	x			x	x		x	x	
Student Mike 11			x	x			x			x
Student Camera 12	x	x			x	x		x	x	
Student Screen 12	x	x			x	x		x	x	
Student Mike 12			x	x			x			x

Table 1. Options using the Student/Program View button

Classroom Resources	Inst Monitor 1	Inst Monitor 2	Inst Audio
Instructor Camera	x	x	
Instruction Window (AVI, MPEG, Power-Point, etc)	x	x	
Computer Screen	x	x	
Whiteboard	x	x	
ELMO	x	x	
Lecture Camera	x	x	
Inst VCR	x	x	
Inst Mike 1			
Room Camera 1 (100 Positions)	x	x	
Room Camera 2 (Fixed)	x	x	
Room Mike 1			x
Room Mike 2			x
ELMO	x	x	
Student Camera 1	x	x	
Student Screen 1	x	x	
Student Mike 1			x
Student Camera 2	x	x	
Student Screen 2	x	x	
Student Mike 2			x
Student Camera 3	x	x	
Student Screen 3	x	x	
Student Mike 3			x
Student Camera 4	x	x	
Student Screen 4	x	x	
Student Mike 4			x
Student Camera 5	x	x	
Student Screen 5	x	x	
Student Mike 5			x
Student Camera 6	x	x	
Student Screen 6	x	x	
Student Mike 6			x
Student Camera 7	x	x	
Student Screen 7	x	x	
Student Mike7			x
Student Camera 8	x	x	
Student Screen 8	x	x	
Student Mike 8			x
Student Camera 9	x	x	
Student Screen 9	x	x	
Student Mike 9			x
Student Camera 10	x	x	
Student Screen 10	x	x	
Student Mike 10			x
Student Camera 11	x	x	
Student Screen 11	x	x	
Student Mike 11			x
Student Camera 12	x	x	
Student Screen 12	x	x	
Student Mike 12			x

Table 2. Options using the Instructor View button

Student Feedback. The *Student Feedback* screen is used to monitor the pace of the instruction (Figure 14). The *Student Feedback* screen shows each student's setting of the *Instruction Pace/Speed* scale (see Figure 15). The **Feedback Req.** button, if selected, prompts students to adjust their *Instruction Pace/Speed* scale. **Station 1-6** displays the *Instruction Pace/Speed* scale data for workstations 1-6. The **Station 7-12** displays the *Instruction Pace/Speed* scale data for workstations 7-12. The **Return to Instruction** button returns the AMX control panel to the Main Control Screen.

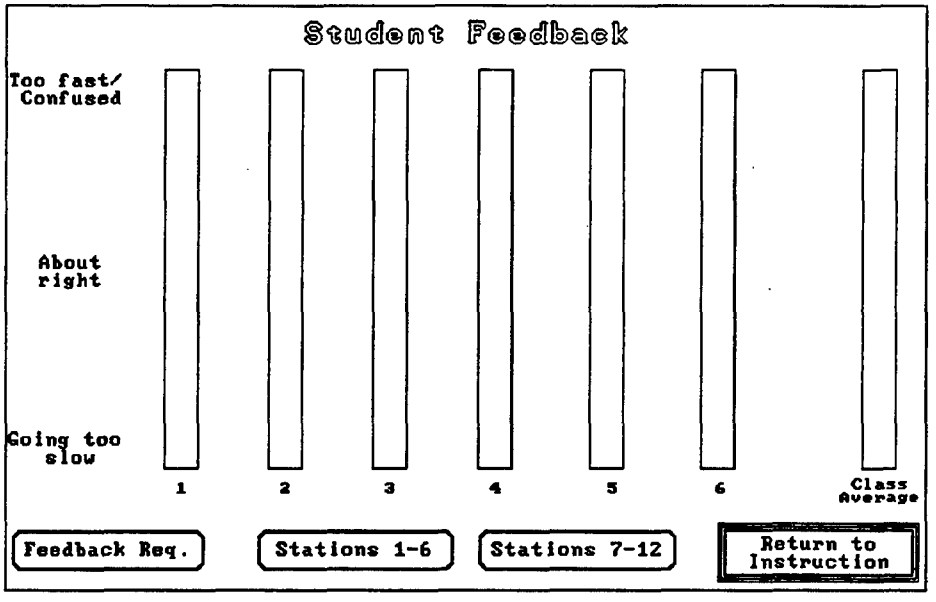

Figure 14. Student Feedback Screen

Classroom site

The classroom site software provides the following system capabilities:

- Lectures
- Questioning
- Demonstrations
- Stand-alone programs

Student Screen

The layout of the IMDL system student screen is shown in Figure 15. There are four main parts to the student screen. They are labeled in Figure 15 and are described below.

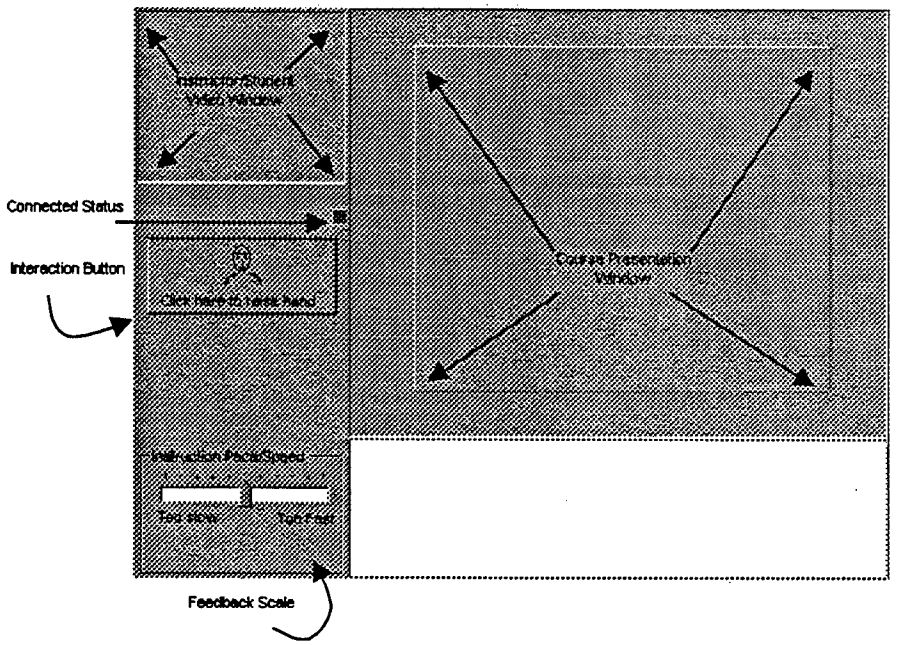

Figure 15. Student Screen

Instructor/Student Video Window. This window provides a view of the instructor (normal mode) or of a student called on by the instructor.

Connected Status. This is a small, square LED type indicator that shows the connectivity status of the student workstation. The indicator is **GREEN** if the student workstation is connected to the classroom server: it is **RED** if the student workstation is not connected to the classroom server.

Course Presentation Window. This is the principal window for presentation of course materials. The instructor has the option of routing the output of several different devices to this window.

Interaction Button. This button is used by a student to *raise-a-hand.* Once called on by the instructor the student may ask a question or to make a comment to the class. If a student changes his/her mind and wants to lower the hand, simply clicking on the button again will lower it.

Feedback Scale. This button is provided to students to let them give the instructor feedback about the pace of the course. Each student station has a **Instruction Pace/Speed** slider that allows a student to indicate if the pace of instruction is too fast or too slow for them. The student can adjust the bar *left* to indicate that the pace is too slow or *right* to indicate that the pace is too fast. A corresponding pace indicator on the instructor's screen indicates the average of all the individual student pace settings.

Classroom Server

The classroom server has three primary functions:

1. The classroom server acts as the routing device for TCP/IP messages.
2. The classroom server acts as the multicast broadcast controller. Digital video files are stored and multicast from the server to provide high quality video to student workstations. Multicasting from the instructor workstation across the T1 line to student workstations sometimes leads to dropped frames and/or loss of audio because of limited bandwidth even with the T1 line.
3. The classroom server is the source of the curriculum content. All curriculum materials, PowerPoint files, games, CBI, digital videos, etc. are stored on and executed from the classroom server.

Helper Applications

Deliver

Deliver is an application that allows the instructor to present course materials. The Deliver application has the following capabilities:

- Gives the instructor access to pre-stored course materials associated with one of the steps of instruction in the course database.
- Allows the instructor to select and execute the material associated with individual course steps.

The instructor initiates a course step by double clicking on one of the steps in the *Course Outline Window*. Course material associated with a step is inserted into the course database using a Course Creation and Maintenance program. Course materials which can be used, fall into the following categories:

PowerPoint Presentations. PowerPoint screens are presented using the *Microsoft* PowerPoint viewer. The viewer is launched on the instructor's computer, the PowerPoint window is automatically sized and positioned into the *Course Presentation Window*, and then the *Course Presentation Window* is shared with students using the *Microsoft* NetMeeting.

Computer Video. Computer videos can be presented to the class using *Percept's* IP/TV player and viewer. A computer video is started when the deliver program sends a signal to the classroom server. The classroom server then launches the IP/TV player which multicasts the video to all student workstations and to the instructor workstation.

CBI. A CBI application can be launched at each student station. Since CBI is inherently self-paced, no control is maintained over the CBI application. It is assumed that students, instructor, or the application knows how to shut down after completion.

Embedded Questions. Pre-programmed multiple choice questions can be displayed on the instructor's screen and on all student screens. Students select one of the possible answers. The program then prompts the student to respond to the question by displaying a **Done** button. If the student is satisfied with the answer he clicks on the **Done** button, the answer is recorded, and the instructor is notified that the question has been answered. Two outputs are tabulated from the results. The first is a bar graph of the distribution of student answers. The second is list of the students and their answers. The instructor can share either result with the students by clicking on the **Share** button.

VCR. The (instructor or classroom) VCR player is set to *Play* mode and the tape is played.

BEC Part One. The *Behavior Evaluation Checklist* associated with the Basic Counseling course is launched on the instructor station and on student stations 2, 5, 8, and 11. It is only started on these student stations because the BEC is part of a collaborative exercise and running it on a few of the classroom stations encourages student collaboration during the exercises. Part one is used to create a checklist to be used for evaluating performance during the practice counseling portion of the exercise.

BEC Part Two. The second half of the *Behavior Evaluation Checklist* is launched on the instructor computer and on all student computers. Since the BEC part two is an independent student exercise, it is launched on each student computer. Part 2 is used by the students to evaluate their peers' counseling skills.

Course Creation/Maintenance

This application permits the instructor to construct a course from various resources. A typical IMDL course can consist of a sequence of presentations stored in the database. This program allows the creation, deletion, and editing of course steps. Using this application a user identifies the steps that comprise a course and sequences the steps into a logical order for class presentation. The software does not provide for the creation of individual course steps. The content for each step must be created with other tools.

WWW Interface

A WWW interface allows both students and the instructor to access the Internet for instructional purposes.

EVALUATION OF IMDL PROTOTYPE DEMONSTRATION

An objective of the IMDL project was to study the feasibility of using the system to deliver technical training, in this instance the Air Force Basic Counseling Course.

Research Design

A posttest only research design was used to examine the feasibility of using IMDL to deliver basic counseling instruction to Air Force students.

Dependent Variables

The dependent variables were grouped into five general classes:

1. Background,
2. Student perception of quality, variety, and effectiveness of the instructional presentations,
3. Student perception of quality and quantity of student-student and instructor-student interaction,
4. Student motivation, and
5. Student performance.

Each of these variables was defined in terms of several related measures, which were gathered using the data collection instruments described below.

Course Selection and Purpose

The course selected by the Air Force, as a testbed to evaluate the IMDL system, was Basic Counseling (J3AIR3S200 000). The Basic Counseling course was designed to train instructors and supervisory personnel in the basic skills of interviewing, counseling, and guiding students in a military academic environment. The scope of training includes human behavior and motivation, basic interviewing and counseling skills, documentation, and practice in application of counseling skills.

Subjects

The subjects were nine (9) active duty Air Force enlisted personnel and one (1) civilian instructor with a variety of specialties (AFSC) and pay grades.

Data Collection Instruments

Five (5) different data collection instruments were used to collect data on the performance of the IMDL system.

Background Questionnaire

The background questionnaire was designed to collect data on student's age, AFSC or government rating, job title, education level, course expectations, computer skills and distance learning experiences (see Appendix A).

Daily IMDL Student Questionnaire (DISQ)

A short questionnaire was designed to assess student perceptions of IMDL effectiveness, quality, the variety of presentations, and the quantity and quality of student participation. This questionnaire was administered twice daily, immediately before lunch, i.e., at the end of the morning class sessions, and at the end of the day (see Appendix B).

Summative IMDL Student Questionnaire

A detailed questionnaire designed to assess student's perceptions of IMDL effectiveness, quality, and variety of presentations and the quantity and quality of student participation was administered at the conclusion of the course (see Appendix C).

Motivation

The students were also administered the Instructional Materials Motivation Scale (IMMS) developed by Keller (1989). The IMMS was used to measure the student's perception of the motivational characteristics of instruction (see Appendix D). It has four sub-scales designed to measure four major motivational factors that are integral to learning:

1. Attention -- arousing curiosity and sustaining the interest of a student.
2. Relevance -- meeting a student's interest and/or goals.
3. Confidence -- helping students feel that they are competent, are in control, and will be successful.
4. Satisfaction -- making the relationship between achievement of learning goals and personal effort visible.

The reliability of the IMMS given by Cronbach's alpha is .89 for attention, .90 for confidence, .81 for relevance .92 for satisfaction and .96 for overall motivation.

Performance

A test was developed to assess Basic Counseling knowledge and skills gained during training (see Appendix E).

Data Collection

All of the instruments were administered by Mei Technology personnel according to the schedule listed in Table 3.

Questionnaire	Time	Date
Background	08:00	September 30, 1997
Daily IMDL Student Questionnaire	11:30	September 30 thru October 3
Daily IMDL Student Questionnaire	15:30	September 30 thru October 3
Performance Test	1300	October 3
Summative Student Questionnaire	14:00	October 3
Motivation	14:30	October 3

Table 3. Evaluation Schedule

Preparation for IMDL

Instruction delivered by the IMDL system required adaptation of the training materials, modifications to the typical classroom layout, and instructor training in operation of the IMDL system.

Training Materials

The Air Force selected the Basic Counseling course as a test-bed to demonstrate the features of IMDL. The goal of the course is aimed at developing basic academic counseling skills in Air Force instructors. In order to achieve this goal, instruction is provided in how to set up an environment conducive to good counseling, how to conduct a basic counseling interview, and how to use counseling techniques appropriate to the situation.

An experienced Mei Technology instructional designer adapted the Basic Counseling course for delivery using the IMDL system. The instructional designer was assisted by Air Force instructional developers at Sheppard AFB. Although the course objectives were not substantially changed, their focus was expanded from simply identifying counseling techniques to actually applying the counseling techniques learned in the course.

The IMDL system provides a variety of instructional delivery capabilities that enable instructional designers the opportunity to incorporate a wide variety of well-known and effective instructional methods and strategies into the course:

- Overhead transparencies, slide shows, or Power-Point presentations are a part of tradition classroom presentations. Generally, Power-Point is used to cover the information being presented point-by-point. Although Power-Point presentations formed the basis of much of the Basic Counseling course, they were used in a non-traditional manner in order to promote student interaction. The slides frequently contained thought-provoking rhetorical questions about the topic area being covered.
- Rhetorical questions were used by the instructor to stimulate discussion and encourage a deeper understanding of concepts. The instructor's role was to act as a facilitator, ensuring that students covered all critical points in the lesson by helping to guide the discussion in the right direction. Care was taken to develop questions that dealt with *application* of knowledge rather than *recall* of factual information. An example of one such question, from the topic area of Human Behavior, is shown in Figure 16.

A student in your class is acting irritable and has withdrawn from the other students. She is looking pale and drawn. Her grades have not been affected. You should:

A. Ignore it because it doesn't affect coursework.

B. Call the student in for a conference and refer her to the correct agency.

C. Talk to the student informally before or after class.

Figure 16. Discussion Question.

- There was extensive use of video, both VHS tapes and digitized video, to highlight interviewing and counseling skills. Computer-based video scenarios were created specifically for this course. They displayed both correct and incorrect examples of interviewing and counseling as well as a wide variety of human behavior traits that the students might encounter when they became academic instructors.
- Computer-based games and puzzles were used for self-evaluation and to improve motivation. For example, a crossword puzzle game was developed with accompanying sound effects to indicate student progress. In a self-assessment game, an interactive version of the hangman game, the student got to see a comic animation of the *hung man* dancing as a reward for completing the exercise successfully.
- Instructors have long used quizzes and in-class questions as a form of student evaluation. Traditionally, quiz answers of one student, two or at most a few students are used to determine the entire class comprehension of the learning material. IMDL takes a different approach. Just as in a traditional classroom, quizzes and questions are used to determine student understanding of the subject matter. However, instead of sampling student comprehension, all students are required to answer questions at their workstations. Whenever a question is asked, feedback to both the instructor and the students is instantaneous. While students may be provided with correct answers to their questions, although this may not always be the case, the instructor's feedback is in the form of a histogram displaying the range of student answers (Figure 17). Using such results, the instructor can take corrective action immediately. If students do not understand the material the instructor can tailor remediation based on the specific kind of mistakes students are making. If students demonstrate mastery of a topic, the instructor can bypass related items that they already know. In addition, if one student or a few students need additional attention, the instructor, using private mode, can tutor those students while the rest of the class works on other instructional material.

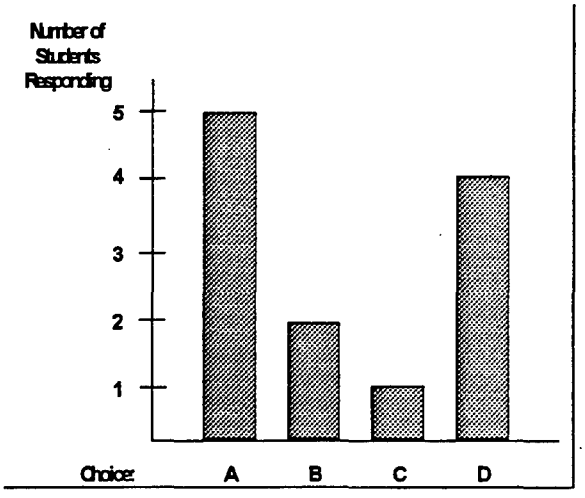

Figure 17. Sample Histogram.

- A significant portion of the course requires that students counsel, be counseled, and evaluate these practice counseling sessions. A Behavioral Evaluation Checklist (BEC) was developed to implement this process. The BEC was used in the following manner:

1. Students were clustered into groups of three students to work together collaboratively. Each group developed lists of counseling behaviors.
2. Student clusters share their counseling behavior lists with the rest of the class and the instructor.
3. The instructor leads a class discussion about the lists. When consensus is reached, the instructor edits the lists to compile a comprehensive list of counseling behaviors agreed to by the class.
4. The students and the instructor use the list to evaluate practice counseling interviews. The students and the instructor use the sliding scales on the BEC to evaluate the degree to which each counseling behavior was exhibited during in a practice counseling session ().
5. At the end of each practice counseling session the student *counselor* is provided with a videotape of the practice counseling session and the BEC ratings of his/her performance made by the instructor and the entire class.

- Videotapes are useful to evaluate procedures. In IMDL, videotapes were used to record each student counseling session. The tapes were played back for use by instructor and students in evaluating counseling procedures. The videotapes enabled the instructor to point out exceptional counseling strategies and behaviors employed by some students. In addition, questions on procedures and differences of opinion regarding BEC ratings could be resolved by simply reviewing the videotape of the session.

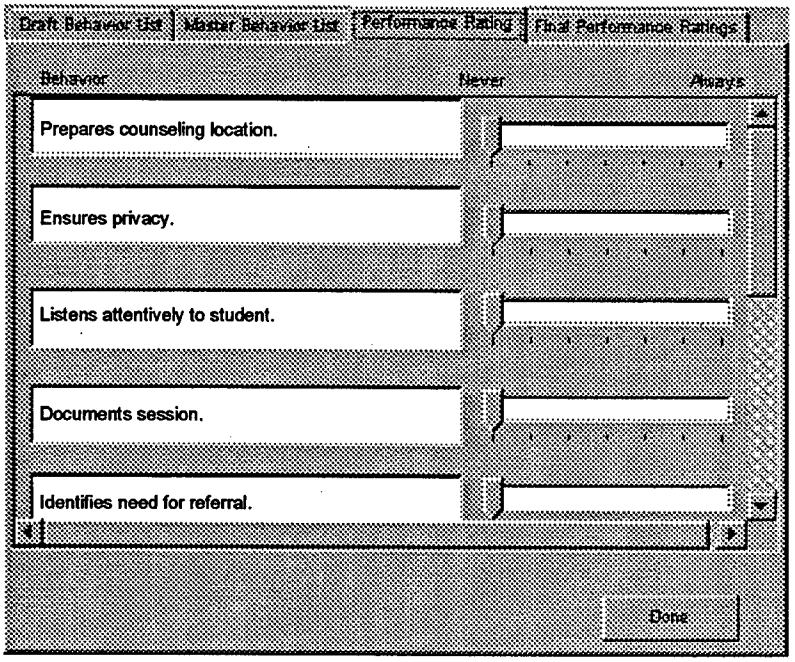

Figure 18. Behavior Evaluation Checklist

Instructor Training

One Air Force (civilian) instructor was trained to operate the IMDL system. The instructor was thoroughly familiarized with IMDL equipment and given practice using the system to display power point presentations, videotapes, AVI files, and embedded questions. The instructor was also familiarized with classroom management functions, e.g., how to gain attention, how to ask questions, how to pass control of the system to a student, how to break the class into groups for exercises, how to execute games, how to control the BEC, procedures for video taping student counseling sessions, and ways to monitor student performance. Formal training for the instructor lasted approximately three (3) days, with most of that time devoted to practice using the IMDL system.

Classroom Design

The classroom was configured as shown in Figure 3.

RESULTS

Results of the IMDL prototype demonstration class are reported here for the six instruments.

Student Background

Student background information was collected using the questionnaire listed in Appendix A. Nine of ten students were enlisted military personnel assigned to be instructors. Five of the military instructors were rated at skill levels 5; four were rated at skill level 7. One student was

an Air Force civilian instructor. The range in ages of the enlisted military instructors was 27-37. The civilian instructor was significantly older than the group, 50. Nine of the students were male and one female. All of the students had completed high school and six (6) had a junior college associates degree.

depicts the students skill and "enjoyment" of different information technologies. Students rated their information technology skills on a 5-point scale (1=Expert → 5= Never Seen It). Students who had used an information technology rated how much they enjoyed using information technology on a 4 point scale (1=Very Much → 4= Not at all). The students were proficient in word-processing and e-mail. A few students (3) reported that they had seen two-way video and two-way audio distance technology but none of the students had ever used distance technology or participated in a distance education course. Overall the students were not very computer literate and do not enjoy using computers, in particular, in learning environments.

	Sample at least seen Technology	Skill Mean	Skill Standard Deviation	Enjoyment Mean	Enjoyment Standard Deviation
Computer and word processing skill	10	2.5	.53	2.5	.71
Computer for graphic or video production skill	8	3.6	.97	2.89	.78
Computer for instructional delivery skill	8	3.5	1.18	2.63	1.06
Video Game skill	10	3.0	.94	3	.82
Computer for business applications skill	9	3.1	1.10	2.37	.52
Computer e-mail skill	10	2.4	.97	2.3	.95
Computer conferencing skill	5	4.0	1.16	2.8	.45
One-way video distance learning with one-way audio skill	4	4.6	.52	3.25	.50
One-way video distance learning with two-way audio skill	2	4.8	.42	3.5	.71
Two-way video distance learning with two-way audio skill	3	4.6	.70	3.33	.58

Table 4. Student's Skill/Enjoyment with Information Technology

Daily IMDL Student Questionnaire

Student perceptions of IMDL were measured twice daily using the questionnaire listed in Appendix B. Each statements was rated on a 5-point scale (A=Unsatisfactory → E= Outstanding). The questionnaire was completed six times by all ten students. In addition, using the same questionnaire, the students were asked to give an overall rating as part of the summative evaluation. The results are presented in . In the table means and standard deviations were computed for the daily ratings. The average rating was above the midpoint "3" indicating that students were positively inclined towards IMDL. The students thought that the instruction was effective, was of good quality, and had variety. In addition, students felt that the amount of interaction and participation was adequate to meet their learning needs.

Mean

Question	Tue. Morning	Tue. Afternoon	Wed. Morning	Wed. Afternoon	Thurs. Morning	Thurs. Afternoon	Student Overall
1. Effectiveness of the instructor's presentations exercises illustrations, etc.	3.56	4.00	4.22	3.90	3.70	3.80	3.80
2. Quality of instructor's presentations exercises illustrations, etc.	3.67	3.89	4.11	3.80	3.80	3.90	3.90
3. Variety of presentations exercises illustrations, etc.	3.56	4.44	4.00	3.70	3.90	3.70	3.90
4. Degree of instructor control.	3.67	3.78	4.00	3.30	3.60	3.40	
5. Difficulty of conducting the instruction.	3.75	3.89	3.78	3.30	3.30	3.80	
6. Amount of instructor-student interaction.	4.11	4.11	4.00	3.80	3.80	4.00	3.80
7. Quality of instructor-student interaction	4.11	3.56	4.00	3.90	4.20	3.80	3.90
8. Amount of student participation.	3.67	3.89	4.00	3.70	3.70	4.00	3.40
9. Quality of student participation	4.11	3.89	4.11	3.70	4.00	3.80	3.70

Standard Deviation

Question	Tue. Morning	Tue. Afternoon	Wed. Morning	Wed. Afternoon	Thurs. Morning	Thurs. Afternoon	Student Overall
1. Effectiveness of the instructor's presentations exercises illustrations, etc.	0.53	0.87	0.67	0.74	0.68	0.79	0.80
2. Quality of instructor's presentations exercises illustrations, etc.	0.71	0.93	0.60	4.10	0.79	0.74	0.74
3. Variety of presentations exercises illustrations, etc.	0.73	0.53	0.87	0.82	0.74	0.66	0.99
4. Degree of instructor control.	0.87	3.67	0.71	0.82	0.70	0.84	
5. Difficulty of conducting the instruction.	0.71	1.05	0.67	0.82	1.06	0.91	
6. Amount of instructor-student interaction.	0.78	0.78	0.71	0.62	1.03	0.82	0.63
7. Quality of instructor-student interaction	0.78	1.33	0.87	0.74	0.92	1.03	0.74
8. Amount of student participation.	1.00	1.33	0.87	0.68	1.06	0.82	1.08
9. Quality of student participation	0.78	1.17	0.71	0.68	0.94	0.79	1.06

Table 5. Mean and Standard Deviation Student Daily Ratings

Summative IMDL Student Questionnaire

Student perceptions of IMDL were also measured with a post course questionnaire listed in Appendix C. The questionnaire contained statements for the students to rate, multiple-choice questions and open-ended questions.

Student Ratings

On the first two sections of the post course questionnaire, students rated the statements using the 5-point scales (A=Unsatisfactory → E= Outstanding) and (A=Not True → E=Very True) respectively All ten students completed the end of course questionnaire.

Technology Evaluation

Students were asked about IMDL technology. Their ratings () were grouped into seven categories: instructor/student video window, headsets/microphone, slides, video, embedded questions, games, and technical support. All of the student ratings were substantially above the midpoint indicating that they liked IMDL technology. The low rating for question 16, "*Technical problems were resolved in a timely manner*," may have several possible explanations. First, there were a few technological problems that significantly affected the progress of instruction over the 3½ days of training. The instructor workstation needed to be rebooted once causing the class to take an early break. There were eight technical problems associated with individual student stations. Technical problems at student workstations caused some student to

miss a part of the instruction. When a student computer malfunctioned, it was not always possible to move to a student another computer because backup computers were not always available. Furthermore, students could not share a computer with another student. Frequently, when a student's computer encountered a problem they could see the instructor, but they could not hear what was being said since audio was routed to their individual headsets rather than to the classroom audio system. The most severe problems were with use of the BEC. The BEC program had bugs that caused students to have trouble entering text. Still another possible cause of the low rating is that the instructor sometimes started up the wrong application, or, even more disconcerting, the instructor started up the same application several times causing confusion[1]. Finally, students may have perceived problems with the technology not revealed by the questionnaire.

Question	Mean	Standard Deviation
Instructor/Student Video Window		
1. The instructor image was large enough to be seen on the computer monitor	4.20	0.63
2. The instructor was clearly seen on the computer monitor.	4.20	0.63
3. The student image was large enough to be seen on the computer monitor.	3.90	0.74
4. The students were clearly seen on the computer monitor.	3.70	1.10
Headsets/Microphone		
5. The headsets were easy to use	3.70	1.25
6. The instructor's voice was clearly heard on the headsets.	3.40	0.97
7. Another student's voice was clearly heard on the headsets.	3.30	1.16
Slides (Student Video Window)		
8. The slides (power point presentations) were clearly seen on the computer monitor	3.90	1.20
9. Details in the slides (power point presentations) were clearly seen on the computer monitor	4.00	1.05
Video (Student Video Window)		
10. The videos were clearly seen on the computer monitor.	4.30	0.66
11. Details in the video could be clearly seen in the computer monitor	3.80	0.63
Embedded Questions (Student Video Window)		
12. The embedded questions (questions) were clearly seen on the monitor.	4.30	0.66
13. The feedback (graphs) associated with each embedded question was a useful learning experience.	3.70	0.95
Games (Stand-alone Applications)		
14. The games (hangman and crossword puzzle) were clearly seen on the computer monitor	4.00	0.63
15. Details in the games were clearly seen	4.40	0.70
Technical Support		
16. Technical problems were resolved in a timely manner.	2.70	1.16

Table 6. Student Ratings of IMDL Technology and Technology Support

Instructor/Course Evaluation

Students were also asked to rate the instructor and the course materials (). The student ratings were grouped into four categories: instructor/course, instructional presentations, interactions, and control. Once again, the average rating was above the midpoint "3" indicating that students felt the quality of instruction was good. They felt that the instructor was prepared and knew the subject matter, presented the lessons clearly, encouraged participation, and answered student questions. In addition, students indicated that the learning activities and instructional aids,

[1] This was caused by the instructor's lack of understanding of the system's processing delays and the lack of system feedback to indicate that a command was received and was being processed. The instructor would sometime repeat a command if it did not appear that the system was responding.

slides, videos, embedded questions, and games supported learning. However, two questions (8 and 16) were below the midpoint. Question 8, "*The course was as good as the best Air Force course I have taken in the past,*" was rated at 2.8 indicating that the students perceived that the IMDL version of Basic Counseling may not have been as good as other Air Force courses that they had taken. The low rating (2.5) for question 16, "*The interactions between students were sufficient to support the learning,*" was expected because use of headsets for audio interfered with student-to-student conversations and reduced class interaction in general. The only way a student could interact with another student was to be called on by the instructor and allowed to talk privately with another student. The interface did not facilitate student-to-student interaction.

Question	Mean	Standard Deviation
Instructor/Course		
1. The instructor was prepared for class.	3.50	0.85
2. The instructor presented the lessons clearly.	3.50	0.97
3. The instructor answered student questions.	4.30	0.82
4. The instructor encouraged class participation.	4.50	0.71
5. The instructor made good use of class time.	3.40	0.97
6. The instructor knew the subject matter.	4.40	0.84
7. The instructor was as good as the best Air Force instructor's that have taught me in the past	4.40	1.27
8. The course was as good as the best Air Force course I have taken in the past.	2.80	1.60
9. The written materials were well written.	3.20	1.03
10. The course provided me with skills that can be applied to my job.	3.70	0.82
Instructional Presentations		
11. The slides (power point presentations) were useful learning experiences.	3.80	1.03
12. The videos were useful learning experiences.	4.40	0.84
13. The embedded questions were a useful leaning experience.	4.00	0.67
14. The games (hangman and crossword puzzle) were useful learning experiences.	4.00	0.11
Interactions		
15. The interactions between the students and the instructor were sufficient to support learning.	3.50	1.18
16. The interactions between students were sufficient to support the learning.	2.50	1.43
17. Class participation supported the learning.	3.40	1.27
Control		
18. The instructor maintained control of the class.	3.90	0.74

Table 7. Student Ratings of the Instructor and the Course

Question	More	No Effect	Fewer
How did IMDL affect your chances to interact with the instructor?	1	4	5
How did IMDL affect your chances to interact with other students?	0	1	9

Table 8. Opportunities to Interact

Question	Traditional	IMDL	No Preference
Which method of instruction would you prefer for this course?	7	0	3

Question	Yes	No
If you had a choice, would you take another IMDL course?	5	5

Table 9. Instructional preference/willingness to participate in another IMDL class

Multiple Choice Questions

The student opportunities to interact and their preference for a method of instruction were assessed with multiple-choice questions. shows that five students felt that their chances for interaction with the instructor were less than in conventional instruction. An additional question asking if the students used the **Raise Hand** interaction button indicated it was used by all of the students. also shows that students felt that IMDL technology significantly affected their

opportunity to interact with other students. shows that students preferred method of instruction was the traditional classroom. The class was evenly split, with half of the students saying that they would be willing to take another IMDL delivered course, if given the option.

Open Ended Questions

Both positive and negative reactions to IMDL were solicited using three open-ended questions. The questions asked students what they liked about the course, what they liked least about the course, and their suggestions for improvement. Student answers were grouped into broad categories ().

Overall students liked seeing new technology. They found the technical difficulties and the slow pace of instruction to be negatives. They suggested that IMDL could be improved by eliminating software bugs, better technology, and a faster pace for the course. The most interesting comments deal with student perceptions of technical difficulties. Student perceptions of problems were different than the system developers. Based on field notes there were eight problems with individual computers that were not resolved within a few minutes. These problems had to be resolved by rebooting the computers which resulted in a short disconnect of three to five minutes. Another possible cause of student perceptions of technical difficulties may have resulted from the instructor's failure to act on system feedback. For example, students pressed the pace button to indicate that instruction was progressing too slowly, but the pace of instruction did not change because the instructor felt that the pace was correct. Still another reason for the perception of technical problems may be that the computer bugs were simply more memorable that other class occurrences.

What did you like most about the course?	Count
• Seeing new technology	8
• Experience distance learning	2
• Variety of exercises	1
What did you like least about the course?	
• Technical difficulty	5
• Pace too slow	4
• Lack of student interaction	1
• Computers	1
Suggestions for improvement?	
• Decrease technical difficulties	8
• Increase the pace	3
• Better technology, i.e. larger monitors, faster computers, etc.	2
• Train instructor better in using the technology	1
• Increase student interaction	1
• Update the suicide videotape	1

Table 10. Open-ended questions

Motivation

The IMMS was used to measure students' perception of the motivational characteristics of the instruction. It has four sub-scales designed to measure the degree to which instructional materials address motivational components: attention, relevance, confidence and satisfaction (ARCS). shows that students rated IMDL instruction motivation characteristics above the midpoint on all four ARCS sub-scales.

reports the score on each individual item of the IMMS. Students rated five measures (10,11,12,21 and 36) below the scale midpoint. The student responses have a common theme: design, organization, and repetition. Students perceived that IMDL instruction needed better design and organization and less repetition.

ARCS	Attention	Relevance	Confidence	Satisfaction
Mean	3.54	3.83	4.13	3.38
Standard Deviation	.46	.68	.39	.72

Table 11. Motivational Characteristics of the Instruction

Sub Scale		Question	Mean	Standard Deviation
a	1.	*There were so many things on each screen that it was irritating.	4.8	0.42
a	2.	*The course looked dry and unappealing.	4.7	0.68
a	3.	*The course was so abstract that it was hard to keep my attention on it.	4.2	1.48
a	4.	*The course was boring.	4.1	0.99
a	5.	The materials were eye-catching.	3.8	1.14
a	6.	The quality of the writing helped to hold my attention.	3.8	0.84
a	7.	Each lesson had things that stimulated my curiosity.	3.4	1.27
a	8.	The variety of presentation, exercises, illustrations, etc., helped keep my attention on the course material.	3.4	0.84
a	9.	I learned some things that were surprising or unexpected.	3.3	1.25
a	10.	There was something interesting at the beginning of each lesson that caught my attention.	3.0	1.16
a	11.	*The amount of repetition in the course caused me to get bored sometimes.	2.8	1.32
a	12.	The way the information was arranged in the course helped keep my attention.	2.7	1.33
c	13.	*I could not really understand quite a bit of the material in the course.	4.9	0.32
c	14.	*Much of the course had so much information that it was hard to identify and remember the important points.	4.5	1.27
c	15.	As I participated in the course, I was confident that I could learn the content.	4.4	0.84
c	16.	After completing the course, I was confident that I would be able to pass a test on what I learned.	4.4	0.70
c	17.	*This material was more difficult to understand than I would have liked for it to be.	4.2	1.40
c	18.	*The exercises in the lessons were too difficult.	5.0	0
c	19.	When I first looked at this course, I had the impression that it would be easy for me.	3.7	1.34
c	20.	After the course introduction, I felt confident that I knew what I was supposed to learn.	3.2	1.14
c	21.	The good organization of the content helped me feel confident that I would learn the material.	2.9	0.99
r	22.	It is clear to me how the content of this course is related to things I already know.	4.2	0.92
r	23.	The content of the course will be useful to me.	4.2	0.79
r	24.	Completing the course successfully was important to me.	4.1	1.28
r	25.	*The course was not relevant to my needs because I already knew most of the material.	3.8	1.23
r	26.	I could relate the content of this course to things I have seen, done, or thought about in my own life.	3.8	0.92
r	27.	The content of the course was relevant to my interests.	3.7	1.16
r	28.	In each lesson there were explanations and/or examples of how to use the knowledge being taught.	3.7	0.68
r	29	The material and style of the course conveyed the impression that its content was worth knowing.	3.6	1.08
r	30	There were stories, pictures, and/or examples that showed me how the course material could be important in my life.	3.4	0.97
s	31	It felt good to successfully complete this course.	4.3	1.06
s	32	Completing the exercises at the end of each lesson gave me a satisfying feeling of accomplishment.	3.7	1.16
s	33	I really enjoyed the course.	3.4	1.27
s	34	I enjoyed the course so much that I would like to know more about this topic	3.0	1.25
s	35	The wording of feedback after the exercises, or of other comments in the lessons helped me feel rewarded for my effort.	3.0	1.41
s	36	It was a pleasure to participate in such a well-designed course.	2.9	0.57

* Note. This indicates that a question was stated in a negative and the responses listed are reversed. That is, for these items, 5=1, 4=2, 3=3, 2=4, and 1=5.

Table 12. Scores of individual items on the ARCS scale

Performance Test

Student knowledge was assessed at the end of the course with a test that contained both matching and multiple choice questions (). Students pass the course with a score of *70* or better on the final examination. All students passed the course.

	Mean	Standard Deviation
Final Exam Score	95.80	3.46

Table 13. Final Exam Scores

Discussion

The objective of this evaluation was to identity advantages and disadvantages of IMDL technology for teaching technical subjects at-a-distance. Two sources of information were used to identify advantages and disadvantages of IMDL: 1) student perceptions and attitudes and, 2) student performance or knowledge.

The student perceptions of the quality, variety and effectiveness of the instructional presentation were highly positive. The students indicated that instruction was effective. Questions about the presentation technology indicated that students felt that the instructor or student image in the *Instructor/Student Video Window* was sufficiently detailed and easy to see. Students also felt that text, graphics, and video presented in the *Course Presentation Window* were easy to read with the necessary details visible. Finally, students felt that text and graphics embedded in games were easy to read and details were visible.

Student perceptions of the quality and quantity of instructor-student interaction were mostly positive. They did not feel that distance hampered their ability to interact with the instructor. However, student perceptions of their ability to interact with other students was negative. They felt that they were not able to fully interact with their classmates even though they were in the same room. There were two potential causes for this lack of interaction: headsets and the IMDL interface.

- **Headsets.** Headsets probably contributed to reducing student-to-student interaction because they slowed down and probably interfered with communication. To interact with another student, the student had to get the instructor's attention by using the **Hand Raise** button. Then, the instructor had to connect one student station to the other. This was a cumbersome process, therefore not used by the instructor. More frequently, since students were in the same classroom, they would remove their headsets and talk over the backs of their classmates. This also caused problems since it caused the background noise in the classroom to raise to the potentially distracting level. A better technological solution must be developed to resolve the lack of student-to-student interaction.
- **IMDL Interface.** As currently configured the IMDL system has no way to mix and scale multiple student images and audio together. A potential solution to this limitation would be to create a multi-student-instructor or multi-student-student interface. A student-student interface involves mixing and scaling multiple sources of audio and video and displaying those sources to interacting members or to the entire class. If a student-student interaction button were added students could join an existing discussion or begin a discussion. After an interaction began, students entering into the interaction would have their image and audio

mixed into the collage of images of students already in the interaction. An example of such an interface is shown in and .

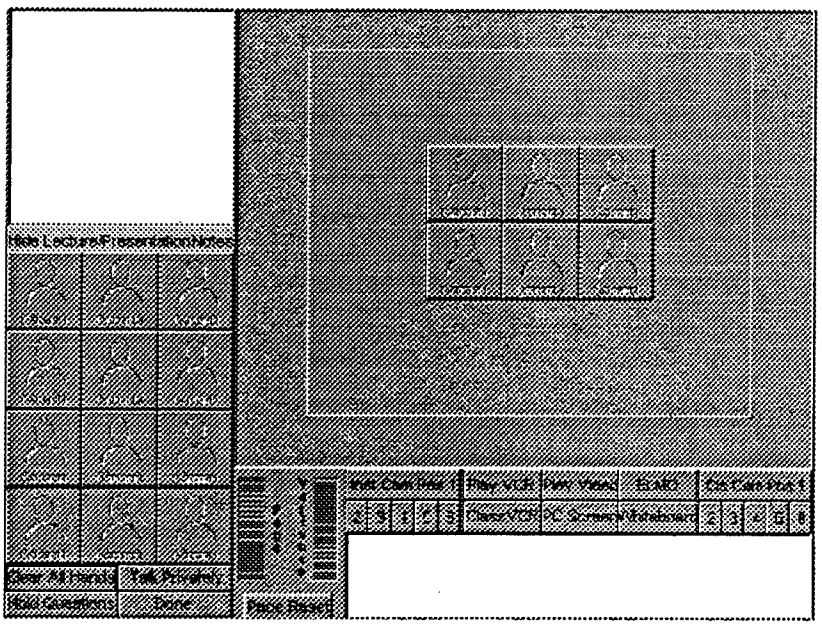

Figure 19. Instructor screen with multi-student-instructor interface

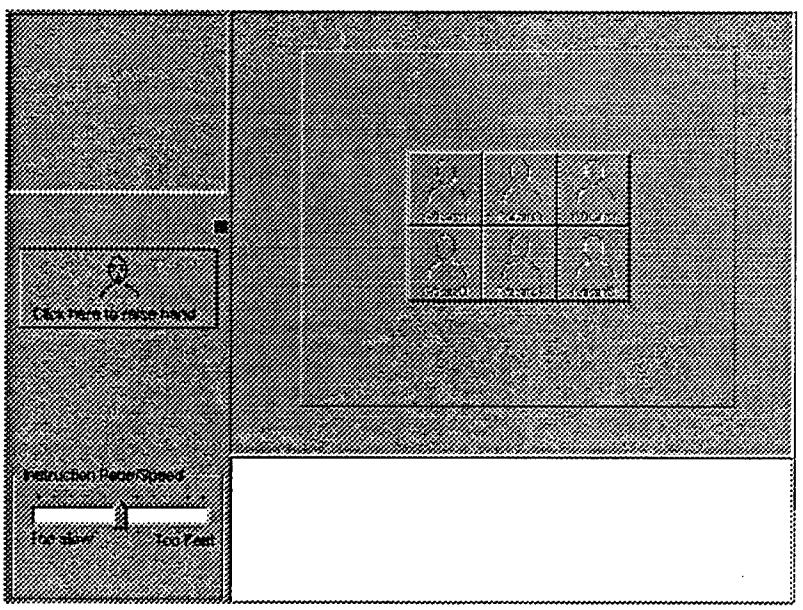

Figure 20. Student screen with multi-student-instructor interface

Students responded to the open-ended questions about technology, technical difficulties, pace and student interaction. Students welcomed the opportunity to work with new technology, however, they did not like the technical problems they encountered. They also felt that the pace of instruction in the prototype course was too slow. In view of fact that there were few technical

difficulties, students perceptions were of many technical problems. Problems with the pace of the course can be traced to two sources: technology and instructor-training. IMDL technology took a long time, i.e., up to one minute, to execute some programs such as a slide show or digital video. This was caused by limited bandwidth across the bridge. The instructor's perception, based on her experience teaching the traditional course, was that the pace indicator was not functioning properly. Typically, she felt that her pace was the correct pace for the topics being covered.

Student responses to the IMMS indicated that the course was motivating. However, an analysis of the individual questions indicates that students perceived problems with the design and organization of the course and felt that there was too much repetition. These results may be related to the instructor's desire in teaching the same way she did in the traditional classroom which may not be effective in an IMDL setting.

The feasibility of using IMDL technology has been demonstrated. A class was successfully conducted, students were trained and graduated, and there were no significant complaints about the training. Student ratings of IMDL technology were mostly positive. The principal criticisms were directed towards glitches in the technology, a lack of student-to-student interaction, and the pace of the course. None of these problems are impossible to overcome. Additional deliveries of the courses using IMDL technology would aid in resolution of system defects and an evolution of better instructional strategies for distance education. Furthermore, a stringent program of instructor indoctrination on how to use the technology and ways to take advantage of it could eliminate some problems perceived to be technology related but actually due to poor instructional techniques.

RECOMMENDATIONS

Work with IMDL focused on a proof of concept test of the technology for delivery of training at-a-distance. Further research needs to be performed on the cognitive, pedagogical, social and cultural implications of learning in such a rich environment as IMDL. In particular, further research could concentrate on:

1. Studying the cost effectiveness of IMDL; compare IMDL with instructor led, CBI, and non-interactive distance education.
2. Developing a set of tools to enable easy and frequent student-instructor and student-student interaction.
3. Developing troubleshooting tools that assist system designers to isolate the source of training problems as either technological or instructional.
4. Identifying instructional techniques and strategies that are effective in an IMDL environment.
5. Studying the range of objectives that can be taught using IMDL technology.
6. Develop tools for converting currently existing courseware so that it is usable in an IMDL type of environment

Finally, IMDL is built using technologies that were and still are undergoing rapid technological innovation. There is a continuing need to monitor technological innovations that can reduce training costs and increase the reliability of systems like IMDL.

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APPENDIX A:
BACKGROUND QUESTIONNAIRE

Background

1. Last four digits SSN _____
2. My age is: _____
3. My AFCS is: _____
4. My job title is: _____

Please circle the appropriate answer below.

5. I am:
   Male
   Female
6. My highest training is:
   3 level
   5 level
   7 level
7. My education level is:
   High School Graduate
   Associate Degree Graduate
   Bachelor Degree Graduate
   Master Degree Graduate
   Ph.D. Graduate
8. How helpful will counseling be to you success as an instructor?
   Very helpful
   Somewhat helpful
   Neither helpful nor not helpful
   Not very helpful
   Not helpful at all
9. How useful will the knowledge of counseling be to your career in the Air Force?
   Very useful
   Somewhat useful
   Neither useful nor not useful
   Not very useful
   Not useful at all
10. How will the knowledge of counseling benefit you personally?
    Very beneficial
    Somewhat beneficial
    Neither beneficial nor not beneficial
    Not very beneficial
    Not beneficial at all

Please circle the appropriate answer below. Please indicate you degree of familiarity with the technology or device according to the following scale:

1. Expert user of the technology, use it on regular basis
2. Proficient in how it is used, use it periodically
3. Familiar with its use, used it a few times
4. Seen it, never used it
5. Never seen it

11. Computer and Word Processing skill is:
1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]
I enjoy using word processors:
1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

12. Computer for Graphic or Video Production skill is:
1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]
I enjoy using graphic or video production tools:
1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

13. Computer for Instructional Delivery skill is:
1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]
I enjoy using computer-based instruction:
1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

14. Video Game skill is:
1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]
I enjoy playing video games:
1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

15. Computer for Business Applications skill is:
1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]
I enjoy using business application tools:
1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

16. Computer e-mail skill is:
1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]
I enjoy using e-mail:
1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

17. Computer Conferencing skill is
1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]
I enjoy using computer conferencing tools:
1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

18. One-way Video Distance Learning skill is:
1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]
I enjoy using one-way video distance learning:
1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

19. One-way Video Distance Learning with Two-way Audio skill is:

1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]

I enjoy using one-way video distance learning with two-way audio:

1 1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

20. Two-way Video Distance Learning with Two-way Audio skill is:

1 [Expert] 2 [Proficient] 3 [Familiar] 4 [Seen it] 5 [Never seen it]

I enjoy using two-way video distance learning with two-way audio:

1 [Very Much] 2 [A lot] 3 [Somewhat] 4 [Not at all]

APPENDIX B:

DAILY IMDL STUDENT QUESTIONNAIRE

Last four (4) digits of SSN:_____

Check Day [ ] Tues. Morning [ ] Wed. Morning [ ] Thurs. Morning
[ ] Tues. Afternoon [ ] Wed. Afternoon [ ] Thurs. Afternoon

There are 9 statements in this questionnaire. Please think about each statement in relation to the instruction and instructional materials you have just studied. The scale is 1 **Unsatisfactory** through 5 **Outstanding**. Give the answer that truly applies to you, and not what you would like to be true, or what you think others want to hear.

Please pencil/pen in the bubble of your choice as in the example below:

Unsatisfactory → Outstanding

1. Effectiveness of the instructor's presentations, exercises, illustrations, etc.

2. Quality of instructor's presentations, exercises, illustrations, etc.

3. Variety of presentations, exercises, illustrations, etc.

4. Degree of instructor control.

5. Difficulty of conducting the instruction.

6. Amount of instructor-student interaction.

7. Quality of instructor-student interaction

8. Amount of student participation.

9. Quality of student participation

Any other Comments: _____

_____

_____

_____

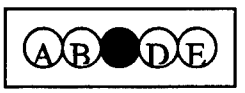
APPENDIX C:

SUMMATIVE IMDL STUDENT QUESTIONNAIRE

Last four (4) digits SSN:_____

Please think about each statement in relation to the instructional materials you have just studied. Tell us what you think. Do not tell us what you think we'd like to hear, or what you think others want to hear.

Please pencil/pen in the bubble of your choice as in the example below:



Unsatisfactory → Outstanding

10. Overall effectiveness of the instructor's presentations, exercises, illustrations, etc.

11. Overall quality of instructor's presentations, exercises, illustrations, etc.

12. Overall variety of presentations, exercises, illustrations, etc.

13. Overall amount of instructor-student interaction.

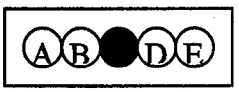
14. Overall quality of instructor-student interaction

15. Overall amount of student participation.

16. Overall quality of student participation

There are 43 statements in this questionnaire. Please think about each statement in relation to the instructional materials you have just studied. Give the answer that truly describes what you think, and not what you would like to be true, or what you think others want to hear.

Please pencil/pen in the bubble of your choice as in the example below:



A = Not True
B = Slightly True
C = Moderately True
D = Mostly True
E = Very True

1. The instructor was prepared for class.

2. The instructor presented the lessons clearly.

3. The instructor answered student questions adequately.

4. The instructor encouraged class participation.

5. The instructor made best use of class time

6. The instructor knew the subject matter.

7. The instructor projected a positive attitude about the subject matter.

8. The instructor image was large enough to be seen in the instructor video window

9. The details in the instructor image were clearly seen in the instructor video window.

10. The instuctor's voice could be heard clearly on the headsets.


11. The headsets were easy to use


12. The instructor maintained control of the class.


13. Other students could be seen clearly in the student video window.


14. Details in the student image were clearly seen in the student video window.


15. A student's voice could be heard clearly on the headsets.


16. The scenarios were a useful learning experiences.


17. The games (hangman, crossword puzzle) were useful learning experiences.


18. Details in the games could be seen clearly in the course presentation window


19. The slides (powerpoint presentation) were useful learning experiences.


20. The slides (powerpoint presentation) could be seen clearly in the course presentation window


21. Details in the slides (powerpoint presentations) could be seen clearly in the course presentation window


22. The videos were useful learning experiences


23. The videos were clearly seen on the computer monitor


24. Details in the video could be seen clearly on the computer monitor


25. The embedded questions were a useful leaning experience.

26. The feedback associated with each embedded question was a useful learning experience.

27. The written materials were well written

28. The interactions between the students and the instructor were sufficient to support the learning objectives.

29. The interactions between students were sufficient to support the learning objectives

30. Class participation supported the learning objectives.

31. The instructor was as good as the best Air Force instructors that have taught me in the past.

32. The course was as good as the best Air Force course I have taken in the past.

33. The course provided me with skills that can be applied to my job.

34. Technical problems were resolved in a timely manner.

Circle your choice

35 How did IMDL affect your opportunities to interact with the instructor?

1. More opportunities
2. No effect on opportunities
3. Fewer opportunities

36 Did you use the interaction button (raise your hand) to ask the instructor questions?

1. Yes
2. No

37 How did IMDL affect your opportunities to interact with other students?

1. More opportunities
2. No effect on opportunities
3. Fewer opportunities

38 Which method of instruction would you prefer for this course?

1. IMDL
2. Traditional instructor led instruction
3. No preference between IMDL and traditional instructor led instruction

39 Which would you prefer?

1. Enrolling in an IMDL course on base.
2. Enrolling in a traditional course off base TDY.

40 If you had a choice, would you take another IMDL course?

1. Yes
2. No

Please answer the following questions by writing your comments in the lines provided

41 What did you like most about the course? _____

_____

_____

42 What did you like least about the course? _____

_____

_____

43 Suggestions for improving the course? _____

_____

_____

APPENDIX D:
ARCS

Last four (4) digits SSN:_____

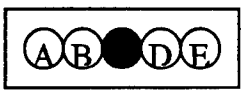
INSTRUCTIONS

1. There are 36 statements in this questionnaire. Please think about each statement in relation to the instructional materials you have just studied, and indicate how true it is. Give the answer that truly applies to you, and not what you would like to be true, or what you think others want to hear.

2. Think about each statement by itself and indicate how true it is. Do not be influenced by your answers to other statements.

3. Please turn the page and complete the questionnaire. All answers are confidential and very important to our research effort. Thank you for your time and effort.

Please pencil in the bubble of your choice as in the example below:



A = Not True
B = Slightly True
C = Moderately True
D = Mostly True
E = Very True

1. When I first looked at this course, I had the impression that it would be easy for me.

2. There was something interesting at the beginning of each lesson that caught my attention.

3. This material was more difficult to understand than I would have liked for it to be.

4. After the course introduction, I felt confident that I knew what I was supposed to learn.

5. Completing the exercises at the end of each lesson gave me a satisfying feeling of accomplishment.

6. It is clear to me how the content of this course is related to things I already know.

7. Much of the course had so much information that it was hard to identify and remember the important points.

8. The materials were eye-catching.

A = Not True
B = Slightly True
C = Moderately True
D = Mostly True
E = Very True

A B C D E	9. There were stories, pictures, and/or examples that showed me how the course material could be important in my life.
A B C D E	10. Completing the course successfully was important to me.
A B C D E	11. The quality of the course helped to hold my attention.
A B C D E	12. The course was so abstract that it was hard to keep my attention on it.
A B C D E	13. As I participated in the course, I was confident that I could learn the content.
A B C D E	14. I enjoyed the course so much that I would like to know more about this topic.
A B C D E	15. The course looked dry and unappealing.
A B C D E	16. The content of the course was relevant to my interests.
A B C D E	17. The way the information was arranged in the course helped keep my attention.
A B C D E	18. In each lesson there were explanations and/or examples of how to use the knowledge being taught.
A B C D E	19. The exercises in the lessons were too difficult.
A B C D E	20. Each lesson had things that stimulated my curiosity.
A B C D E	21. I really enjoyed the course.
A B C D E	22. The amount of repetition in the course caused me to get bored sometimes.

A = Not True
B = Slightly True
C = Moderately True
D = Mostly True
E = Very True

(A)(B)(C)(D)(E) 23. The material and style of the course conveyed the impression that its content was worth knowing.

(A)(B)(C)(D)(E) 24. I learned some things that were surprising or unexpected.

(A)(B)(C)(D)(E) 25. After completing the course, I was confident that I would be able to pass a test on what I learned.

(A)(B)(C)(D)(E) 26. The course was not relevant to my needs because I already knew most of the material.

(A)(B)(C)(D)(E) 27. The wording of feedback after the exercises, or of other comments in the lessons, helped me feel rewarded for my effort.

(A)(B)(C)(D)(E) 28. The variety of presentation, exercises, illustrations, etc., helped keep my attention on the course material.

(A)(B)(C)(D)(E) 29. The course was boring.

(A)(B)(C)(D)(E) 30. I could relate the content of this course to things I have seen, done, or thought about in my own life.

(A)(B)(C)(D)(E) 31. There were so many things on each screen that it was irritating.

(A)(B)(C)(D)(E) 32. It felt good to successfully complete this course.

(A)(B)(C)(D)(E) 33. The content of the course will be useful to me.

(A)(B)(C)(D)(E) 34. I could not really understand quite a bit of the material in the course.

(A)(B)(C)(D)(E) 35. The good organization of the content helped me feel confident that I would learn the material.

(A)(B)(C)(D)(E) 36. It was a pleasure to participate in such a well-designed course.

APPENDIX E:
FINAL EXAM

NAME_____ **DATE: 3 Oct 1997**

Match each word in column 2 with its definition in column 3. In column 1 write the number of the definition (column 3) of the word (column 2).

Answer	Word	Definition
	Affective Counseling	(1) Attributing one's desires and characteristics unto others
	Motivation	(2) Clients are basically good and behavior is goal-directed
	Reaction Formation	(3) Developing attitudes and behaviors that are opposite to one's true feelings
	Stress	(4) Emotional/creative part of an individual
	Reinforcement	(5) Helping students whose attitudes and behaviors do not meet AF standards
	Privacy	(6) Inner drive that prompts a person into action
	Child	(7) Interaction in which the counselor makes an effort to contribute positively to the client's improvement
	Projection	(8) Must be present so the counselor/client relationship is not limited
		(9) Physiological response to demands
		(10) Rewarding appropriate behavior

Answer	Word	Definition
	Follow-up	(1) Determines the effectiveness of counseling session(s).
	Compensation	(2) Giving unconditional understanding and respect
	Confidentiality	(3) Helping a client to change environment to alter their behavior
	Acceptance	(4) Helping clients change their thoughts in order to control their emotions
	Referral Agencies	(5) Maintained only when it does not violate any legal implications
	Self-understanding	(6) Putting self into client's situation to see things as they do
	Behavioral Counseling	(7) Reducing the tension by accepting a less preferred but more attainable goal
	Development	(8) Someone else to help a client
		(9) Three stage process that includes exploration
		(10) Where a client commits to a plan

Match each word in column 2 with its definition in column 3. In column 1 write the number of the definition (column 3) of the word (column 2).

Answer	Word	Definition
	AETC Form 173	(1) External and internal psychological changes related to emotion
	Cognitive Counseling	(2) People are capable of both rational and irrational thought
	Emotional Characteristics	(3) Helping students whose attitudes and behaviors do not meet AF standards
	Helping Relationship	(4) Used to document academic and nonacademic counseling
	Negative Reinforcement	(5) Intent to show that a clients feelings are correctly understood
	Non-academic Counseling	(6) Helping clients change their thoughts in order to control their emotions
	Rational-emotive theory	(7) Interaction in which the counselor makes an effort to contribute positively to the client's improvement
	Reflection of feeling	(8) Intellectual tool use to understand behavior and feelings
	Ulterior	(9) Used to document nonacademic counseling only
		(10) Transactions with double meaning
		(11) Removal of disapproval, criticism, or nagging as a result of appropriate behavior

Choose the one response to each of the following questions.

1. During what part of the counseling process does the counselor help the client understand the problem?

   a. Prepare

   b. Conduct

   c. Document

   d. Follow-up

2. What is done with the documentation after formal counseling is conducted?

   a. Give the documentation to the student

   b. Throw it away after the student signs it

   c. Send a copy to the student's squadron

   d. Keep it until the student moves to the next block of training

The following dialogue will be used to answer questions 3 and 4.

AMN A: "I don't want to be in this class anymore, it's stupid!"

AMN B: "It's not an easy or fun class, but it will be useful to us once we get through it."

3. From what ego state is AMN B speaking?

   a. Adult

   b. Parent

   c. Natural Child

   d. Adaptive Child

4. What kind of transaction is represented in the dialogue?

   a. Healthy

   b. Complementary

   c. Unhealthy

   d. Uncomplimentary

5. What kind of responses do people make automatically and may not be aware of doing so?

a. Nonverbal

b. Attending

c. Reflexive

d. Responding

6. What individual difference is being acknowledged by an instructor who personalizes the goals of instruction for a particular student?

a. Motivation

b. Ability

c. Physical

d. Emotional Characteristics

7. When setting up the counseling environment, what is the primary goal?

a. Total confidentiality

b. An interruption free environment

c. A comfortable seating arrangement

d. An atmosphere conducive to communication

8. Ultimately what will a counselor's "personal" theory of counseling be?

a. Affective Approach

b. Behavioral Approach

c. Cognitive Approach

d. Combination Approach

9. What do people use to help succeed in meeting daily stressers but also to excuse immature behavior?

a. Motivation

b. Adjustment Mechanism

c. Transactional Analysis

d. Cognitive Counseling

10. How should informal counseling be documented?

a. AF Form 174

b. Memo in client's folder

c. AETC Form 173 signed by the client

d. AETC Form 173 not signed by the client

11. Suicidal tendencies arise from what kind of individual differences?

a. Emotional Characteristics

b. Physical

c. Background/experience

d. Ability

12. What counseling approach is an instructor using when she tells a student, "After you study hard and increase your grade with the next exam treat yourself to a movie."

a. Affective Approach

b. Behavioral Approach

c. Cognitive Approach

d. Combination Approach

13. What is the essential component of the counseling helping relationship?

a. Skills

b. Advice

c. Confidentiality

d. Attitude

14. What occurs in the preparation stage of counseling?

a. Interview is initiated

b. Exploration of the student's problem

c. Emphasize the importance of counseling session

d. Collection of background information

15. Which sentence is an example of sincerity?

a. "My counselor really understands what I'm saying"

b. "I feel my counselor doesn't judge me."

c. "If my counselor says he'll do something, he'll do it."

d. "My counselor takes a lot of time to listens to me"

16. What stages does the counseling interview include?

a. Initiation, development, and closing

b. Initiation, documentation, and closing

c. Initiation, development, and follow-up

d. Initiation, self-exploration, and follow-up

17. What technique, if used properly, can direct communication?

a. Attending

b. Responding

c. Silence

d. Questioning

Student: I can't believe I failed that exam. I'm such a loser!

Instructor: You think you're a loser for failing an exam. Do you think that only losers fail or that maybe that successful people have these hurdles too?

18. Which approach is illustrated in the above example?

a. Affective Approach

b. Behavioral Approach

c. Cognitive Approach

d. Combination Approach

19. What is the counselor's responsibility after referring a client?

a. Arranging for a follow-up

b. Making all the contacts

c. No responsibilities remain

d. Explaining that it is mandatory that the client accept the referral

20. When is counseling considered successful?

a. When the client tells you there is improvement/change

b. When the sessions are completed

c. When improvement/change can be observed

d. When the client speaks favorable of the counseling process

21. During what part of the counseling session is it determined if further assistance is needed?

a. Closing

b. Follow-up

c. Referral

d. Conduct

22. AMN Swanson has spent his whole life in Greenbay, Wisconsin while his roommate AMN Wachael grew up in Peru and Texas. The two get along all right, but they experience some conflict. What individual difference may be contributing to their problems?

a. Ability

b. Physical

c. Background/experience

d. Emotional characteristics

23. What is the first step in referring a client?

a. Counselor should try and fix the problem

b. Complete the counseling documentation

c. Finish the counseling session

d. Assess the local resources

The following dialogue will be used to answer questions 24 and 25

AMN Kubiak and AMN Churilla just received their scores from the last exam. Both performed very poorly. AMN Kubiak's response is, "You know this score isn't bad. It won't affect my final grade at all. I'm doing alright." AMN Churilla replies with, "Easy for you to say. I could have done better. And I would have, if that guy in front of me would have just sat still. All his wriggling around distracted me."

24. What adjustment mechanism is AMN Churilla using?

a. Rationalization

b. Denial of Reality

c. Projection

d. Reaction Formation

25. By not acknowledging the poor test grade, what is AMN Kubiak trying to do?

a. Understand the questions that were missed

b. Develop an argument to present to the instructor

c. Protect his self-concept

d. Hide his test score from AMN Churilla